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1819.
STARCH.

STARCH, a substance which is extracted from wheat flour, by washing it in water. All farinaceous seeds, and the roots of most vegetables, afford this substance in a greater or lesser degree; but it is most easily obtained from the flour of wheat, by moistening any quantity thereof with a little water, and kneading it with the hand into a tough paste: this being washed with water, by letting fall upon it a very slender stream, the water will be rendered turbid as it runs off, in consequence of the fecula or starch which it extracts from the flour, and which will subsist when the water is allowed to stand at rest. The residuum of the flour, which remains after the water has extracted all the fecula, and runs off colourless, will be found to be gluten; which see.

The starch so obtained, when dried in the sun, or by a stove, is usually concocted into small masses of a long figure and columnar shape, which have a fine white colour, scarcely any smell, and very little taste. If kept dry, starch in this state continues a long time uninjured, although exposed to the air. It is not soluble in cold water; but forms a thick paste with boiling-hot water, and when this paste is allowed to cool, it becomes semitransparent and gelatinous, and being dried, becomes brittle, and somewhat resembles gum.

Starch, although found in all nutritious grains, is only perfect when they have attained maturity, for before this it is in a state approaching to mucilage, and so mixed with saccharine matter and essential oils, that it cannot be extracted in sufficient purity to concretize into masses.

Wheat, or such parts of it as are not used for human food, are usually employed for manufacturing starch, such as the refuse wheat and bran; but when the finest starch is required, good grain must be used. This, being well cleaned, and sometimes coarsely bruised, is put into wooden vats, full of water to ferment; to afford the fermentation, the vats are exposed to the greatest heat of the sun, and the water is changed twice a day, during eight or twelve days, according to the season. When the grain bursts easily under the fingers, and gives out a milky white liquor when squeezed, it is judged to be sufficiently softened and fermented. In this state, the grains are taken out of the water by a sieve, and put into a canvas sack, and the husks are separated and rubbed off, by beating and rubbing the sack upon a plank; the sack is then put into a tub filled with cold water, and trodden or beaten till the water becomes milky and turbid, from the starch which is taken up from the grain. A scum sometimes swims upon the surface of the water, which must be carefully removed; the water is then run off through a fine sieve into a settling-veil, and fresh water is poured upon the grains, two or three times, till it will not extract any more starch, or become coloured by the grain. The water in the settling-veils being left at rest, precipitates the starch which it held suspended; and to get rid of the saccharine matter, which was also dissolved by the water, the vats are exposed to the sun, which soon produces the acetic fermentation, and takes up such matter as renders the starch more pure and white. During this process, the starch for sale in the shops receives its colour, which consists of small mixed with water and a small quantity of alum, and is thoroughly incorporated with the starch; but this starch is unfit for medicinal purposes. When the water becomes completely clear, it is poured gently off from the starch, which is washed several times afterwards with clean water; and at last is placed to drain upon lines clothed supported by hurdles, and the water drips through, leaving the starch upon the cloths, in which it is pressed or wrung, to extract as much as possible of the water; and the remainder is evaporated, by cutting the starch into pieces, which are laid up in airy places, upon a floor of plaster or of slightly burnt bricks, until it becomes completely dried from all moisture, partly by the access of B
warm air, and partly by the floor imbibing the moisture. In winter-time, the heat of a flove must be employed to effect the drying. Lastly, the pieces of dried flarch are scraped, to remove the outside crust, which makes inferior flarch, and these pieces are broken into smaller pieces for sale.

The grain which remains in the sack after the flarch is extracted, contains the husks and the glutinous part of the wheat, which are found very nutritious food for cattle.

The French manufacturers, according to Les Arts et Meiters, pursue a more economical method, as they are enabled, by employing an acid water for the fermentation in the first infusion, to use the most inferior wheat, and the bran or husks of wheat. This water they prepare, by putting a paiful of warm water into a tub, with about two pounds of leaven, such as some bakers use to make their dough rise or ferment. The water stands two days, and is then fired up, and half a paiful of warm water added to it; then being left to settle till it is clear, it is poured off for leue. To use this water in the fermentation of the materials, a quantity of it is poured into a tub, and about as much fair water is poured upon it as will fill the tub half full: the remainder of the tub is then filled up with the materials, which are one half refuse wheat, and other half bran, and the other half of the materials is divided into two similar tubs and ferments during ten days, or less, according to the strength of the leaven-water, and according to the disposition of the weather for fermentation. When the materials have been sufficiently steeped, or fermented, an unctuous matter, which is the oil of the grain, will be seen swimming on the surface, having been thrown up by the fermentation. This must be scummed off; and the fermented grain, being taken out of the tub, is put into a fine hair-fieve, placed over a settling-tub, when fair water is poured upon it, and washed through the fieve into the tub; by which means the flarch is carried through the fieve with the water, of which about six times the quantity of the grain are used.

The water stands in the settling-tub for a day, and becomes clear at top; when it is carefully laded out of the tub, leaving at the bottom a white sediment, which is the flarch. The water which is taken off is four, and is called fare water; this is the proper leuen for the first steeping of the materials. The flarch now obtained must be rendered marketable; for which purpose, as much water is poured upon it as will enable it to be pounded with the hovel and hoved through the fieve, and then it is filled up with fair water. Two days after this, the water is laded out of the tub, and the flarch appears in the bottom, but covered over with a dark-coloured and inferior kind of flarch, which is taken off, and employed for fattening hogs. The remainder of the sediment, which is good flarch, is washed several times, to remove all the inferior flarch; and when this is done, about four inches of thick flarch should be found at the bottom of each tub: but the quantity varies, according to the goodness of the meal or bran which has been used. It is evident that the refuse wheat, when employed for making flarch, ought to afford more, the whole being used, than the bran or husks; but the flarch so extrasted is always of an inferior quality to that which is extrasted from the bran of good wheat, particularly in the whiteness of its colour. The flarch in the different tubs is brought together into one, and there worked up with as much water as will dilute it into a thin paste, which is put into a filk fieve, and strained through with fresh water. This water is settled in a tub, and afterwards poured off, but before it is to completely settle as to lode all its white colour; this renders the flarch which is deposited still finer and whiter, and the flarch which is deposited by the water so poured off is of a more common quality.

The flarch thus purified is taken out of the bottom of the tubs, and put into wicker-baskets, about 18 inches long and 2 feet, rounded at the corners, and lined with linen cloths, which are not fastened to the baskets. The water drips from the flarch through the cloths for a day, and the baskets are then carried up to apartments at the top of the house, where the floor is made of very clean white plaster; and the windows are thrown open, to admit a current of air. Here the baskets are turned downwards upon the plaster-floor, and the linen cloths, not being fastened to the baskets, follow the flarch, and, when taken off, leave loaves, or cakes of flarch, which are left to dry a little, and are then broken into small pieces, and left on the plaster-floor till very dry. But if the weather is at all humid, the flarch is removed from the plaster-floor, and spread out upon shelves, in an apartment which is warmed by a flove, and there it remains till perfectly dry. The pieces are afterwards scraped, to remove the outside crust, which makes common flarch; and the foraped pieces being again broken small, the flarch is carried to the flove, and spread out to a depth of three inches, on hurdles covered with cloths. The flarch must be turned over every morning and evening, to prevent it from turning to a greenish colour, which it would otherwise do.

Those manufacturers who are not provided with a flove, make use of the top of a baker's oven to spread the flarch upon; and after being thoroughly dried here, it is ready for sale.

Starch may be made from potatoes, by soaking them about an hour in water, and taking off their roots and fibres, then rubbing them quite clean by a strong bruishe: after this they are reduced to a pulp, by grinding them in water. This pulp is to be collected in a tub, and mixed up with a large quantity of clear water: at the same time, another clean tub must be provided; and a hair-fieve, not too fine, must be supported over it by two wooden rails extended across the tub. The pulp and water are thrown into the fieve, and the flour or flarch is carried through with the water; fresh water must then be poured on, till it runs through quite clear. The refuse pulp which remains in the fieve, being boiled in water, makes an excellent food for animals; and the quantity of this pulp is near seven-eighths of all the potatoes employed. This pulp is sometimes, when the flour is turbid, and of a darkish colour, from the extractive matter which is dissolved in it. When it is suffered to rest for five or six hours, all this matter departs or settles to the bottom, and the liquor which remains is to be poured off as ufeles; and a large quantity of fresh water is thrown upon the flour, and stirred up; it is then settled for a day, and the water being poured off, the flour will be found to have again settled in a whiter fiate. But to improve it, another quantity of water is poured on, and mixed up with it; in which state it is passed through a fine filk-fieve, to arrest any small quantity of the pulp which may have escaped the first hair-fieve. The whole must afterwards be suffered to stand quiet, till the flour is entirely setteled, and the water above become perfectly clear; but if the water has any sensible colour or taste, the flour must be washed again with fresh water, for it is absolutely necessary that none of the extractive matter be suffered to remain with it. The flour, when thus obtained pure, and drained from the water, may be taken out of the tub with a wooden hovel, and placed upon wicker-frames covered with paper, to be dried in some situation properly defended from dust.

When the manufacture of flarch from potatoes is attempted in a large way, some kind of mill must be used to reduce
STARCH.

reduce them to a pulp, as the grating of them by hand is too tedious an operation. A mill invented by M. Baume is very complete for this purpose. In its general structure it resembles a large coffee-mill: the grater consists of a cone of iron-plate, about seven inches in diameter, and eight inches in height, the exterior surface of which is made toothed, like a rasp, by piercing holes through the plate from the inside. This cone is fixed upon a vertical axle, with a handle at the top to turn it by; and is mounted on the pivots of the axe, within a hollow cylinder of plate-iron, toothed within like the outside of the cone; the smallest end of the interior cone being uppermost, and the larger or larger end being as large as the interior diameter of the hollow cylinder. A conical hopper is fixed to the hollow cylinder, round the top of it, into which the potatoes are thrown; and falling down into the space between the outside of the cone and the inside of the hollow cylinder, they are ground, and reduced to a pulp, when the interior cone is turned round by its handle; and as the lower part of the cone is fitted close to the interior diameter of the cylinder, the potatoes must be ground to a fine pulp before they can pass through between the two. The machine, when at work, is placed in a tub filled with water; and as fast as the grinding proceeds, the pulp mixes regularly with the water, ready for the process before described.

Mr. Whately of Cork has also proposed a mill for the same purpose, on a different plan. The grater is a cylinder, with its axis horizontal, and turned by a handle at one end, with a fly-wheel to regulate the motion. A hopper is placed over the cylinder, into which the potatoes are thrown, and are grated by resting upon the cylinder, as it revolves round. There is also an horizontal box opposite to the cylinder, into which the potatoes are received from the hopper, through a sliding-door; and a moveable end, which is fitted to the box, is pressed forwards towards the cylinder by a lever and weight, so as to force the potatoes contained in the box against the cylinder, which, being kept in constant motion, shreds away the potatoes into a pulp with great rapidity, and it falls into a box beneath.

In the year 1796, lord William Murray obtained a patent for manufacturing starch from horse-chestnuts. The method was to take the horse-chestnuts out of the outward green prickly husk, and either by hand, with a knife or tool, or else with a mill adapted for the purpose, the brown skin was carefully removed, leaving the chestnuts perfectly white, and without the smallest speck. In this state the nuts were rasped or ground to a pulp with water, and the pulp washed with water through a coarse horse-hair sieve, and twice afterwards through finer sieves, with a confluent addition of clear cold water, till all the starch was washed clean from the pulp which remained in the sieve; and the water being letted, depotted the starch, which was afterwards repeatedly washed, purified, and dried, in the same manner as the potato-starch before described. We are not informed if this manufacture has been carried into effect.

The starch was used along with malt, or stone-blue, to stiffen and clear linen. The powder of it is also used to whiten and powder the hair.

It is also used by the dyers, to dispense their stuffs to take colours the better.

Starch is sometimes used instead of sugar-candy for mixing with the colours that are used in strong gum-water, to make them work more freely, and to prevent their cracking.

It is also used medicinally for the same intentions with the viscous substance which the flour of wheat forms with milk, in fluxes and catarrhs, under various forms of powders, mixtures, &c. A drachm of starch, with three ounces of any agreeable spirituous water, and a little sugar, compone an elegant jelly, of which a spoonful may be taken every hour for two. These gelatinous mixtures are likewise an useful injection in some diarrhoeas, particularly where the lower intestines have their natural mucus abraded by the flux, or are constantly irritated by the acrimony of the matter. Starch is the common vehicle for the exhibition of opium per anum.

By 43 Geo. III. c. 68. sched. (A), upon every hundred weight of starch imported a duty is imposed; and by 49 Geo. III. c. 98. sched. (A), another duty upon every hundred weight is imposed.

No person shall be a maker of starch within the limits of the head-office of Excise in London, unless he occupies a tenement of 10l. a year, or upwards, for which he shall be assessed in his own name, and also pay to the poor-rates; nor elsewhere, unless he pay to the church and poor; or if there are no such rates, to the rate on houses and windows, under the same penalty as for making starch without entry. (19 Geo. III. c. 40. f. 3. 26 Geo. III. c. 51. f. 20.) By 43 Geo. III. c. 69. sched. (A), every starch-maker shall take out a licence, for which he shall pay 5l., and renew the same annually within ten days before the end of the year, on pain of 50l. 24 Geo. III. c. 41. And the places of making starch are to be entered, under penalty of 200l. (24 Geo. III. c. 48. 2.) All rooms and places, vellies and utensils, shall be marked and numbered, under the penalty of 50l. (19 Geo. III. c. 40. f. 12.) Flour, and other materials, found in any private place, and all private utensils and vellies for making or keeping starch, unentered, shall be forfeited, or their value. (10 Ann. c. 26. f. 22.) Every starch-maker shall cause his name to be painted over his door, or on some conspicuous part of the front of his house, with the addition of "starch-maker," on penalty of 100l. (24 Geo. III. c. 48. 2.) Officers may at all times enter and survey, and make return to the commissioners, leaving a true copy of the quantity, if demanded, under his hand, with the maker; and if he leave not such copy, after it has been demanded in writing (12 Geo. I. c. 28.), he shall forfeit 40l. (10 Ann. c. 26. f. 14.) Notice of emptying the vats, and of taking the waters out of the tubs, shall be given, on pain of forfeiting 100l. (19 Geo. III. c. 40.) The maker shall use regular, square, or oblong boxes only, for boxing and draining his green starch, before it is dried in the flore, on pain of 10l.; and give notice of boxing, and an account of drying, &c. Nor shall he remove any starch after it is dried, before it be weighed, &c. by the officers, on pain of 200l. (4 Geo. II. c. 14. 19 Geo. III. c. 40.) All starch, before it be put into any flore or place to dry (except for crusting), shall be put in papers, tied up with wrappings, palled over with a piece of paper of a different colour, and stampt by the officer, under penalty of 100l. (26 Geo. III. c. 51.) Forging or using forged stamps incurs a forfeiture of 50l. (26 Geo. III. c. 51.) The maker shall have just scales and weights, on pain of 10l.; and if he shall use insufficient scales or weights, he shall forfeit 100l. (10 Geo. III. c. 44.) Removing starch before due notice is prohibited by 10 Ann. c. 26. f. 19. And if it be removed before it is weighed by the officers, the person so offending shall forfeit 200l. (19 Geo. III. c. 40.) And if any dealer in starch shall receive more than 28 lbs. not duly marked, he shall forfeit 200l. 24 Geo. III. c. 48. 10 Ann. c. 26. f. 16.

Clandestine manufacture, or concealing of starch, exposes the party concerned, unless he can make it appear that the duty...
STA

duty has been paid, to a forfeiture of 50l.; and obstructing the officer in entering, seizing, &c. the same, incurs a forfeiture of 100l. (4 Geo. II. c. 14. 23 Geo. II. c. 21.)

And by 19 Geo. III. c. 40. if the maker shall conceal any starch, with intent to defraud his majesty of the duties, he shall forfeit 100l. Weekly entry shall be made, on pain of 50l.; and the duties shall be cleared within one week after entry, on pain of double duty. No starch shall be imported, except in packages containing at least 224 lbs., on pain of forfeiture, and of 50l. from the matter of the vessel. (42 Geo. III. c. 93.) Starch that hath paid the duties may be exported with a drawback of the duties. (10 Ann. c. 26. 27 Geo. III. c. 13.)
The officers of excise or customs may seize any starch or hair-powder, with the horse and package, suspected on good reason to have been privately made, or imported without payment of duty, or relanded after drawback; and if the party doth not make it appear that the duty hath been paid, they shall all be forfeited, with an additional forfeiture of 50l. for every hundred weight. (4 Geo. II. c. 14.) If any person shall knowingly harbour or conceal any starch unlawfully imported, or relanded after shipping for exportation upon debenture, he shall, whether he claim any property in it or not, forfeit 50l. for every hundred weight, together with the goods and package. (23 Geo. II. c. 21.)

No perfumer, &c. shall make use of, or offer to sale, any hair-powder made of or mixed with alabaster, talc, plaster of Paris, whiting, lime, &c. (sweet scents only excepted), on pain of forfeiting the same, and 50l. (12 Ann. stat. 2. c. 9.)

And if any maker of hair-powder shall mix any powder of alabaster, &c. (rice first made into starch, and sweet scents only excepted), he shall forfeit the same, and 50l. (12 Ann. stat. 2. c. 9.)

Or if any one maker or seller shall mix any such materials in the making of starch, or powder of starch, or rice made into starch, he shall forfeit the same, and 10l. Places for making hair-powder are to be entered, and officers may enter and survey them, under a penalty of 20l. 4 Geo. II. c. 14.

Every maker of flax-blue for sale shall make entry of his name, place of abode, place of manufacture and keeping, and materials, on pain of 50l. (26 Geo. III. c. 51.) Officers may enter and survey without obstruction, under penalty of 50l.; nor shall any flour, meal, or other ingredients (other than for colouring the same), be used, except starch for which the duties have been paid, on pain of forfeiting the same and 100l.

Nor shall any maker of flax-blue or hair-powder for sale receive into his possession any starch in papers not stamped, under pain of forfeiting 10l. a pound, together with the same; and if any maker shall keep above 28 lbs. of starch or hair-powder in any unentered place, the same shall be forfeited and also 50l. 26 Geo. III. c. 51.

All the preceding forfeitures shall be sued for, levied, and mitigated, as by the laws of excise, or in the courts at Westminster; and be distributed, half to the king and half to the person in whose possession.

STARCHY Matter of Roots, Plants, and Seeds, in Rural Economy, is a material which forms a principal part of a great number of excellent articles of different kinds, upon which their nutritive properties and qualities probably in a great measure depend when used as the food of man, or employed in the feeding and fattening of several different kinds of domestic animals. See STARCH.

Thus, it is ascertained to exist in considerable quantities in the root of the potatoe and some other roots, in many different plants of the edible kind, and to constitute the greatest part of most grains, pulse, and seeds which are employed as food. It is met with in a large proportion in the different nourishing vegetable substanices which are known and made use of under the names of fage, falep, arrow-root, tapioca, cattava, and some others. In regard to the roots, plants, and perhaps seeds, derived from weeds, it is known to abound much in the root of arum maculatum, or wake robin, of the wild or English hyacinth, of white bryony, of meadow saffron, and of a variety of others. It is very predominant in numerous wild plants, and most probably in most of their seeds.

Sir Humphrey Davy conceives, that this matter or coagulated mucilage, which forms the greatest part of all grains and seeds which are used in the way of food, is generally combined with gluten, oil, or albuminious matter. In corn, with gluten; in pulse, such as peas and beans, with albuminous matter; and in rape-seed, linseed, hemp-seed, and the kernels of most nuts, with oils. He found that one hundred parts of good full-grained wheat sown in the autumn, afforded seventy parts of starch and nineteen parts of gluten: that one hundred parts of wheat sown in the spring yielded seventy-five parts of starch and twenty-four parts of gluten: that the same number of parts of Barbary wheat gave seventy-four parts of starch and twenty-eight parts of gluten; and that an equal number of parts of Sicilian wheat afforded seventy-five parts of starch and twenty-one parts of gluten. He has also tried different species of North American wheat, all of which have contained rather more gluten than the one of British growth.

In general, it is said, the wheat of warm climates abounds more in gluten and in soluble parts; and is of greater specific gravity, harder, and more difficult to grind, than that of others: and that the wheat of the south of Europe, in consequence of containing a larger proportion of gluten, is peculiarly fitted for making macaroni, and preparations of flour in which a glutinous quality is considered as an excellence.

In some trials made on barley, he obtained, from one hundred parts of a full, fair, Norfolk, foot, seventy-nine parts of starch, fix of gluten, and eight of hulk; the remaining seven parts consisting of sweet or facharine matter. The fugar in barley is suggested as probably the chief cause why it is more proper for malting than any of the other sorts of grain. It is stated that Einhoff, in his minute trials on barley-meal, found in three thousand eight hundred and forty parts, three hundred and fifty of volatile matter, forty-five parts of albumen, two hundred of facharine matter, one hundred and seventy and four parts of mucilage, nine pounds of phospate of lime, with some albumen, one hundred and thirty-five of gluten, two hundred and fifty of hulk, with some gluten and starch, two thousand five hundred and eighty of starch not quite free from gluten, and seventy-eight parts of losl in the whole. And that rye afforded to the same experimenter, in the same number of parts, two thousand five hundred and twenty of meal, nine hundred and thirty of hulk, and three hundred and ninety of moisiture: the same quantity of meal, on being analyzed, gave two thousand three hundred and forty-five of starch, one hundred and twenty-five of albumen, four hundred and twenty-five of mucilage, one hundred and twenty-five of starch, and two hundred and fifty-five of facharine matter, and three hundred and sixty-five of gluten not dried. The remainder bulk and losl.

The first of these writers obtained from one thousand parts of rye, which was grown in Suffolk, sixty-one parts of starch and five of gluten.

One hundred parts of oats, from Suffex, afforded him fifty-nine parts of starch, fix of gluten, and two of facharine matter.

One thousand parts of peas, grown in Norfolk, also afforded
STA

forsed him five hundred and one parts of starch, twenty-two of saccharine matter, thirty-five of albuminous matter, and sixteen parts of extract, which became insoluble during the evaporation of the saccharine fluid.

From three thousand eight hundred and forty parts of marsh beans, *vicia faba*, the latter writer is flated to have obtained one thousand three hundred and twelve of starch, thirty-one of albumen, and one thousand two hundred and four of other matters which may be conceived to be nutritive; such as gummy, flarchy, fibrous matter, analogous to animal matter.

The same quantity of kidney beans (*phaseolus vulgaris*) is said to have afforded him, one thousand eight hundred and five parts of matter analogous to starch, eight hundred and fifty-one of albumen and matter, approaching to animal matter in its nature, and seven hundred and ninety-nine of mucilage.

From the same number of parts of lentils he is also flated to have obtained one thousand two hundred and sixty-five parts of starch, and one thousand four hundred and thirty-three of a matter analogous to animal matter, which he describes as a glutinous insoluble or semi-insoluble in water; but soluble in alcohol when dry, having the appearance of glue; probably, it is supposed, a peculiar modification of gluten.

Different tuberous, bulbous, and common roots contain a large portion of starch matter, but it probably abounds most in the potato. It is said that these roots in general afford from one-fifth to one-seventh of their weight of dry starch. And that from one hundred parts of the common potato obtained from twenty to twenty-five parts of starch and mucilage; the same number of parts of the apple potato afforded for Humphrey Davy in various trials, from eighteen to twenty parts of pure starch. From five pounds of several other different varieties, in the trials of another experimenter, from twelve to eighteen ounces and a quarter of starch have been ascertained. It is added, that from the analysis of Einhoft, it appears that seven thousand fix hundred and eighty parts of potatoes afford one thousand one hundred and fifty-three of starch, five hundred and forty of fibrous matter analogous to starch, one hundred and seven of albumen, three hundred and twelve of mucilage in the state of a fat solution; in the whole, two thousand and one hundred and twelve parts. So that a fourth part of the weight of the potato at least may, it is said, be considered as nutritive matter. Hence its great utility as an article of food for man, and its great application in the feeding and fattening of animals.

The propriety of encouraging the production of starch from vegetable roots, plants, and products, has been some time since suggested by Mr. Pitt in his account of the Agriculture of Staffordshire, and which is said to equally apply to the preparation of this substance from any other vegetable which may not be a leading article of food, as well as to the production of hair-powder, paste, and other articles generally made from starch.

STARK, in Geography, a town of the county of Tyrol; 13 miles N.E. of Landeck.

STAREIN, a town of Austria; 4 miles S. of Hardegg.

STARENBERG, a town of Upper Bavaria, on the Wurmfe; 14 miles N.E. of Weilheim.

STARDARD, or STARGARD, a town of Prussian Pomerelia, situated on the forts; now belonging to Prussia; 20 miles S. of Danzig. N. lat. 53° 57'. E. long. 18° 20'.

STARGARD, or Old Stargard, a town of Germany, which gives name to a circle in the duchy of Mecklenburg; 55 miles S.E. of Gutfro. N. lat. 53° 30'. E. long. 13° 17'.

STARGARD, or New Stargard, a town of Germany, in the circle of Upper Saxony, capital of a duchy, and like-wise of the whole Hinder Pomerania. Its vicinity produces corn and excellent vegetables in great plenty. As it lies on the Ina, it has a free communication with the Baltic. It is a large and well-built town, containing two churches, with one in the suburb, and a conventual church, where Lutherans, Germans, and French Calvinists, perform their public worship. Near the town is a noble college, founded in 1481, by burger Master Peter in the year 1481; and improved with regard to its constitution in 1704. Here are likewise a free-school, with divers good manufacturies and a considerable trade; 74 miles N.E. of Berlin. N. lat. 53° 28'. E. long. 15° 20'.

STARI-BESUSITZ, a town of Croatia; 30 miles W. of Bihacs.

STARIOGARD, a ruined town of Servia; 12 miles S.S.E. of Noribiar.

STARIKILIA, a town of European Turkey, in Dobrudia, on a branch of the Danube; 6 miles E. of Ismail.

STARING, in Rural Economy, a term signifying the fame as hidebound.

STARIKT, in Geography, a river of Silezia, which runs into the Biella, near Fryewald, in the principality of Neisse.

STARIKA, a town of Russia, in the government of Tver, on the Volga; 44 miles S.W. of Tver. N. lat. 56° 24'. E. long. 35° 14'.

STARK, a county of Ohio, containing the seven following townships, viz. Canton, with 845 inhabitants; Killback, with 532; Nimnitzkillen, with 385; Osnaburg, with 55; Planer, with 57; Sandly, with 198; and Tuscarawa, with 154; amounting in all to 2724.

STARKA, in Botany, received that name from the pen of professor Willdenow, in honour of the Rev. Mr. Starka, a clergyman at Grotziboura, in Silezia, who has paid great attention to the cryptogamic plants of that country, and is the author of an essay on *Bifusus Judikus*, in the first volume of Sims and Konig's Annals of Botany. — Willd. Sp. Pl. v. 3. 2216. Alt. Hort. Kew. v. 5. 118. - Clais and order, *Symgnesia Polygonum superflua*. Nat. Ord. Compositae distinctes. Linne. Corymbifera, Julia. Common Composite or Groat. Starka, imbricated, with numerous, linear-lanceolate, straight scales; the inner ones gradually longer; the innermost with elongated, smooth, very narrow points. Cor. compound, radiated. Florets of the disk not very numerous, perfect, tubular, funnel-shaped, with an equal, five-cleft, reflexed limb; those of the radius numerous, ligulate, emarginate, female, spreading, twice as long as the disk. *Stam.* in the perfect florets, Filaments five, capillary; anthers united into a tube, prominent in the mouth of each floret. *Pfl.* in both kinds of florets, German inerferly conical; style capillary, longer than the corolla; stigmas two, linear, deeply separated, revolute. *Peric.* none, except the permanent calyx. *Seeds* solitary to each floret of the disk and radius, inerferly conical. Down simple, sessile, capillary, smooth. *Recept* clothed with fine hairs, nearly equal to the feed-down.


1. S. umbellata. Umbel-flowered Starka. Willd. n. 1. Ait. n. 1. (Amelius umbellatus; Linn. Sp. Pl. 276. Amoen. Acad. v. 5. 407. Swartz Obs. 310. Solidago n. 1.) Browne Jan. 320. t. 35. f. 2.—Native of the cooler woods and mountains of Jamaica, a beautiful and uncommon plant. *Brown* Miller appears to have cultivated it in 1768. Linnaeus, justly unwilling to multiply genera, referred this plant to *Amelius*, at the same time remarking how very
very different it was from the A. Lyschnis. In this case the habit, supported by the character of the hairy, not chaffy or scaly, receptacles, fully authorizes a separation. The stem is herbaceous, erect, from two to three feet high, somewhat angular, clothed with dense white cottony down, intermixed with brown hairs; leafy in the lower part; forked at the summit, the central branch longest. Leaves opposite, flat, ovate, acute, finely and sharply serrated; tapering at the base; green and smooth, though covered when young with deciduous cottony down, on the upper side; always very white, soft, and densely woolly, beneath; somewhat triple-ribbed, with many branching veins. Flower-stalk feathery, at the top of each branch, simple, hairy and downy, an inch or two long, forming a sort of umbel, with a few lanceolate bracteas at its base. Calyx half an inch long, somewhat cottony. The flowers are yellow, an inch in diameter. Browne says the taste of the herb is aromatic, leaving a sweetness upon the palate, not at all in this clafs. He supposed it must be a fine vulnerary. Its cottony texture, no doubt, would contribute to stanch the blood of a fresh wound.

STARKENBACH, in Geography, a town of Bohemia, in the district of Koniggratz; 11 miles N.N.E. of Ciechlin.

STARKENBERG, a town of Prussia, in the province of Nacangen; 17 miles E.S.E. of Konigsberg.—Also, a town of France, in the department of the Sarre; 1 mile N. of Traarbach.

STARKS, a township of America, in the district of Maine and county of Somerset, on the W. side of Kennesaw river, containing 828 inhabitants; 35 miles N.W. of Augusta.

STARKSBOROUGH, a town on the flate of Vermont, in Addison county, containing 756 inhabitants; 12 miles E. of Ferrisburgh.

STARKSTADT, a town of Bohemia, in the circle of Koniggratz; 8 miles W. of Branau.

STARKLACKEN, a town of Prussia, in the province of Bartenland; 9 miles S. of Bartenfien.

STARLING, or STARE, in Ornithology. See Sturnus.

The common starling is about the size of the common black-bird; the weight of the male being about three ounces, and that of the female somewhat less; the bill, in old birds, is yellow; the whole plumage black, very repellent, with changeable blue, purple, and copper; each feather being marked with a pale yellow spot; the inner coverts are edged with yellow, and slightly glossed with green; the quill-feather and tail are dully; the former edged with yellow on the exterior side, the latter with dirty white; the legs are of a reddish-brown. These birds breed in hollow trees, eaves of hovelles, towers, cliffs, and high rocks over the sea; they lay four or five eggs of a pale greenish-ash colour; they feed on worms and insects, and, it is said, will get into pigeon-holes, and pick the eggs; in winter they assemble in large flocks; their flesh is to bitter, as to be scarcely edible; they are very docile, and may be taught to speak. Pennant.

Mr. Ray mentions a beautiful species, described by Bonituz under the name of the Indian starling, or fumus Indicus. This is of the size and shape of our common starling, but is variegated with a deep blue, a lead-colour, and a pale grey, and has on its head a very beautiful yellow crefl. It learns to imitate the human voices, and talks much better than the parrot, but is troublesome in being over noisy.

STARLING Colour, a particular colour of a horse. See Colour.

STARE, in Commerce, a corn measure in Italy. At Mantua, a staro of corn weighs 80 lbs. and 86 such measures are = 85 English bushels nearly, or 80.94 staro = 10 English quarters, and each staro = 2135 cubic inches. At Ferrara, 93.23 staro = 10 English quarters, and each staro = 1845 cubic inches. At Florence, 118.70 staro = 10 English quarters, and each staro = 1449 cubic inches. See Italian Dry Measures.

STARODUB, in Geography, a town of Russia, in the government of Novgorod Sieverkoe; 44 miles N. of Novgorod Sieverkoe. N. lat. 57° 35'. E. long. 33° 44'.

STAROSEOLO, a town of Russia, in the government of Mogilev; 20 miles N.N.W. of Rogatchev.

STAROSTE, in Modern History, a name given in Poland to the governors of cities and castles. They are appointed by the king to superintend his revenues, and to administer justice in his name. The district subject to the jurisdiction of each is called starosta. However, there are some starosts who have no jurisdiction.

STARSCH, in Geography, a town of Moravia, in the circle of Znyam; 15 miles N. of Budweis.

START BAY, a bay of the English Channel, on the coast of Devonshire, between Dartmouth and Start Point.

START POINT, a cape of England, on the S.W. coast of the county of Devon; 9 miles S. of Dartmouth. N. lat. 59° 13'. W. long. 1° 28'.

STARTING, among Brewers, the putting of new beer, or ale, to that which is decayed, to revive it again.

STARTING, in the Management. A horse is said to be flaring, skittish, or timorous, that takes every object he sees to be otherwise than it is; upon which he flies, flaps out, and flutters suddenly to one side, infomuch, that the rider cannot make him come near the place where the object is. This fault is more common to geldings than mares, horses. Such horses also as have bad eyes are most subject to it, as well as those who have been kept a long time in a stable without airing; but these last are easily cured of it. When you have a skittish horse, never beat him in his confinement, but make him advance gently, and with soft means, to the scare-crow that alarms him, till he recovers it, and gains assurance.

STARTZ, in Geography, a town of Moravia, in the circle of Znyam; 25 miles N. of Znyam.

STARTZOV, a bay or gulf of the Frozen ocean, on the coast of Russia. N. lat. 68° 16'. E. long. 40° 14'.

STARVEGUT BAY, a bay on the S.W. coast of Jamaica. N. lat. 17° 58'. W. long. 77° 45'.

STARTING to Death, a kind of punishment used by the people of Aragon some ages ago; and it is reported by Tavernier, that the chief ladies in the kingdom of Tonquin are at this day starved to death for adultery.

STARWITZ, in Geography, a town of Silesia, in the principality of Grottau; 3 miles N. of Pachtchau.

STARZEL, a river of Wurtemberg, which runs into the Neckar, 5 miles above Rotenburg.

STASAVITZ, a town of European Turkey, in Bofnia; 22 miles S. of Banjaluka.

STASFURT, a town of Wethphalia, in the duchy of Magdeburg; 20 miles S. of Magdeburg. N. lat. 51° 53'. E. long. 11° 45'.

STASIDA, a small island in the Mediterranean; 8 miles N.W. of Scarpanto. N. lat. 35° 53'. E. long. 26° 44'.

STASIS, in Ancient Geography, a town of Aetia, in the Pelopon; built upon a large rock.

STASIS, a word used by physicians to express a flagration of the humours. See STATE, in Geography, a town of Sweden, in Warmeland; 23 miles W. of Carlsbad.
STATE.

STATE, or ESTATE, an empire, kingdom, province, or extent of country under the same government. See ESTATE.

A state or nation, for in this place we consider the terms as synonymous, is a body politic, or a society of men united to promote their mutual safety and advantage by their union. From the very design that induces a number of men to form a society that has its common interests, and ought to act in concert, it is necessary that there shall be established a public authority, to order and direct what ought to be done by each in relation to the end of the association. This political authority is the sovereignty; and laws they, when there are laws, are from it.

It is evident, therefore, from the very act of the civil or political association, that each citizen subjects himself to the authority of the entire body, in every thing that relates to the common welfare. The authority of all over each member must, therefore, essentially belong to the body politic, or to the state; but the exercise of that authority may be placed in different hands, according as the society shall ordain. If the body of the nation keeps its own hands the empire, or the right of command, it is a popular government; or "democracy" if it refers it to a number of citizens, or to a senate, it establishes a "republic," an "oligarchy," or an "aristocracy;" or if it considers the government a single person, it is a "monarchy;" and this monarch may be limited or absolute. See SOCIETY, GOVERNMENT, and SOVEREIGNTY.

Every nation that governs itself, whatever may be the form of that government, without any dependence on a foreign power, is a "sovereign state." Its rights are the same as those of any other state: and if it be sovereign and independent, it must govern itself by its own authorities and laws. Indeed, there are many sovereign states. Those states may be reckoned in this class, which have nevertheless bound themselves to another more powerful by an equal alliance: and these unequal alliances may be infinitely varied. But whatever they are, provided the inferior ally refers to itself the sovereignty, or the right of governing its own body, it ought to be considered as an independent state, that keeps up correspontence with others, under the authority of the law of nations. Thus, a weak state seeks protection from one that is more powerful, and from gratitude secures the benefit of the law of nations. The laws are also of election, referring to itself the right of government and sovereignty. Thus also, though a weak state may pay tribute to a foreign power, and by so doing in some degree diminish its dignity, yet still its sovereignty may subsist entire. In some cases, sovereignties have been given in seft, and sovereigns have voluntarily rendered themselves feudatories to others; yet if the homage leaves independency and sovereignty in the administration of the state, and only means certain duties to the lord of the seft, or even a mere honorary acknowledgment, it does not prevent the seft, or the feudal prince, from being truly sovereign. Two sovereign states may also be subject to the same prince, without any dependence on each other, and each may retain all its national rights, free and independent. In short, several sovereign and independent states may unite themselves together by a perpetual confederacy, without each in particular ceasing to be a perfect state. They will form together a federal republic; the deliberations in common will offer no violence to the sovereignty of each member, though they may, in certain respects, put some constraint on the exercise of its power, in virtue of voluntary engagements. But a people that has passed under the dominion of another, can no longer form a state, and in a direct manner make use of the law of nations. Such were the people and kingdoms which the Romans rendered subject to their empire; most, even of those whom they honoured with the name of friends and allies, no longer formed states. Within themselves they were governed by their own laws and magistrates; but without, they were obliged in every thing to follow the orders of Rome; they dared not of themselves make either war or an alliance, and could not treat with nations. The preservation of a nation conflicts in the direction of the political associations of which it is formed; and the perfection of a nation is found in what renders it capable of obtaining the end of civil society. In a perfect state, when nothing necessary is wanting to arrive at that end. The end of civil society is procuring for the citizens whatever their necessities require, the conveniences and accommodations of life, and, in general, whatever constitutes happiness; with the peaceful possession of property, a method of obtaining justice with security, and, in short, a mutual defence against all violence from without. In order to form a just idea of the perfection of a state or nation, every thing must confine to promote these ends. The fundamental regulation that determines the manner in which the public authority is to be executed for the attainment of these ends, is what forms the "constitution of the state." The constitution is, in fact, nothing more than the establishment of the order in which a nation proposes to labour in common for obtaining those advantages with a view to which the political society was established. The laws are regulations established by public authority to be obeyed in society. All these ought to relate to the welfare of the state and of the citizens. The laws made directly with a view to the public welfare are the "fundamental laws," and in this class are the laws that regulate the body itself, and the being of society, the form of government, the manner in which the public authority is to be executed; and those, in a word, which together form the constitution of the state, are the "fundamental laws." The "civil laws" are those that regulate the conduct and behaviour of the citizens among themselves. The constitution and its laws are the basis of the public tranquillity, the firmest support of the public authority, and pledge of the liberty of the citizens. But this constitution is a vain phantom, and the civil laws are useless, if they are not religiously observed. The nation ought then to watch very attentively, in order to render them equally respected by those who govern, and by the people destined to obey. To attack the constitution of the state, and to violate its laws, is a capital crime against society; and if those guilty of it are invested with authority, they add to this crime a perfidious abuse of the power with which they are entrusted. From the principles here stated, we may infer, that a nation has a right to form, maintain, and perfect its constitution, and to regulate at pleasure every thing relating to the government, while no person has a right to hinder it. Government is established only for the sake of the nation, with a view to its safety and happiness. If any nation is dissatisfied with the public administration, it may reduce it to order, and reform the government. The nation may do this, but not any discontented and querulous malcontents. The body of a nation has a right to call to account those who abuse their power; but if the nation be silent, it is not the business of a small number of citizens to put the state in danger under the pretence of reforming it. If the nation be uneasy under its constitution, it has a right to change it.

If it be asked, what ought to be done if the people are divided?
STA

STA

divided? According to the common method of states, the opinion of the majority must pass, without dispute, for that of the whole nation; otherwise it would be impossible for the society ever to take any resolution. It appears then, for the same reason, that a nation may change the constitution of the state by a majority of votes, and whenever there is nothing in this change that can be considered as contrary to the act of the civil association, or to the intention of those united under it, all are bound to conform to the will of the majority, or to be quit of the form of government, to which alone it appeared that the people were willing to submit, on their entering into the bonds of society; if the greatest part of a free people, after the example of the Jews in the time of Samuel, are weary of liberty, and resolved to submit to the authority of an absolute prince, the citizens more jealous of that privilege, so invaluable to those who have enjoyed it, though obliged to suffer the majority to do as they please, are under no obligation at all to submit to the new government; they may leave a society, that seems to have dissolved itself, in order to be united under another form; and have a right to retire elsewhere, to fell their lands, and take with them all their effects.

After all it may be observed, that great changes in a state being delicate and very dangerous affairs, and that frequent changes being in their own nature prejudicial, a people ought to be very circumspect in doing it, and never be inclined to make innovations without the most prefling reasons, or an absolute necessity. The spirit of inconstancy which prevailed among the Athenians, was always contrary to the happiness of that republic, and was a length fatal to that liberty of which they were so jealous, without knowing how to enjoy it. Vattel's Law of Nations, b. i.

STATE, Civil. See CIVIL.

STATE, Free. See FREE.

STATE is also used for the policy or form of government of a nation. Hence, ministers of state, reasons of state, &c. See GOVERNMENT.

STATE, Council of, in Modern History, was projected by the states of Holland, Zealand, and Utrecht, in conjunction with William I. prince of Orange, and erected, in 1578, with ample authority. All affairs of state, the army, and revenue, were entrusted to the care of this council; but the states, growing jealous of this extraordinary power, reduced it gradually; and by a new instruction, in 1651, the disposition of military affairs, and the command of the army, were in part transferred to the states-general, with the advice of the council. In this council, the provinces were represented by such a number of deputies as bore some proportion to the quota of money which each contributed for the support of the whole. Groningen excepted. Guelderland had one. Holland three, Zealand two, Utrecht one, Friesland two, Overfjeld one, and Groningen two. These were all changed every three years, except the deputy from the nobility of Holland, and the two from Zealand, who enjoyed their posts for life. Here every member had a decisive voice, and presided for a week in his turn, without regard to the rank of the provinces. The governors or stadtholders of the provinces had a seat, but no decisive vote in this council, in which affairs were determined by a majority of voices. See Stadtholder.

STATE of a Diphed, the same with acme.

STATE WIND. See WIND.

STATELY, in the Manage. A horse is said to be stately, that goes with a proud, strutting gait.

STATEMENT, in Geography, an island belonging to the United States of America, and forming the county of Richmond, in the state of New York. It is situated below the bay of New York, and is the southern extremity of the state. It is of ancient date, having been represented by two members in the colonial legislature in 1691. The centre of Staten Island is about 11 miles S.W. of New York; it is about 14 miles long, and its greatest breadth is about 8 miles; the area is about 77 square miles, or 49,280 acres. It is bounded on the N. and W. by Newark bay and Brunswick river, E. and S. by Hudson river and the Atlantic ocean. Its southern extremity is in N. lat. 40° 39', and the western extremity 16° W. long. from New York.

The towns are, Castletown, containing 1301 inhabitants; Northfield, including 1595; Southfield 1007, and Weisfield 1444 inhabitants; the whole population being 5347, and the number of electors 500. The county of Richmond is hilly and broken, including some extensive tracts of good arable land. Its insular situation, and the benefit it affords to mariners, have given it celebrity, and several privileges to its inhabitants. The surrounding waters abound with a variety of fish. The quarantine ground for ships entering the port of New York lies in this county. It lends one member to the house of assembly.

STATELAND, an island at the extremity of South America, separated from Terra del Fuego by the strait of Le Maire. In the appearance of Staten Land, when Cook visited it in January 1769, he did not discover the wildness and horror ascribed to it in the account of lord Anson's voyage. On the N. side, Hawkeworth 1751, in his detail of this voyage (vol. ii. p. 64.), are the appearances of bays or harbours; and the land was destitute neither of wood nor verdure, nor was it covered with snow. The island seemed to be about 12 leagues in length, and 5 broad. On occasion of another voyage he visited it in January 1775, and gives the following account of it. (Second Voyage, vol. ii. p. 200.) Staten Land lies nearly E. by N. and W. by S., and is ten leagues long in that direction; and no where above three or four leagues broad. The coast is rocky, much indented, and seemed to form several bays or inlets. It shews a surface of craggy hills which rise to a vast height, especially near the west end. Except the craggy summits of the hills, the greater part was covered with trees and shrubs, or some sort of herbage, and there was little or no snow on it. The currents between Cape Desada and Cape Horn set from W. to E., that is, in the same direction as the coast; but they are by no means considerable. To the E. of the cape their strength is much increased, and their direction is N.E. towards Staten Land. They are rapid in Strait Le Maire, and along the S. coast of Staten Land, and let like a torrent round Cape St. John, where they take a N.W. direction, and continue to run very strong both within and without New Year's files. S. lat. 54° 49'. W. long. 65°.

STATE, an ancient silver coin, weighing four Attic drachms, and worth about three shillings or three shillings and a penny farthing. See DRACHM.

There was also a gold coin under this name: that of Cyzicus was much valued, having on one side the figure of a woman's head, and on the other that of the head of a lion; in weight it was equal to two drachms, and in value to twenty-eight silver drachms of Athens. The gold staters of Athens was equal in value to twenty drachms, and a drachm of gold was equal to about ten of silver.

The ancient gold piece, gold stater, or "Philippus," as it was called in compliment to Philip of Macedo, was a drachm; and there is reason to believe, that it passed for twenty silver drachms on its first appearance; but in later times for twenty-five Greek drachms, or Roman denarii. That the gold coins of Philip, called "Philippi," were di-

STATELAND,
drachmas, we know from ancient authors, and from the great number of them that still remain; and that the χρυσός, or chief gold coin of Greece, was of the same weight, is also evident from ancient authors. Being of twenty silver drachmas, it was anciently worth 1 s. 6d.; but valuing gold now at a medial price of 41. per ounce, it is intrinsically worth 1 l. at present. But we have larger gold coins than the χρυσός or didrachm. The ηχρυσός of Alexander, and of Lycurgus, weighs its double, or about two hundred and sixty-five grains, and palled for forty silver drachmas, or 17. 1s. 6d.; now worth 2l. Of Lycurgus, Antiochus III., and of some of the Egyptian monarchs, we have even the τριχρυσός, or quadruple χρυσός, weighing about five hundred and thirty grains, and current for eighty drachmas of silver, 1 gu., now worth 8l. sterling. We have also minuter coins, such as the τετραχρυσός, or half the χρυσός, of Hiero I. of Syracuse, and of Pyrrhus, which weighed three drachmas, and palled for ten silver drachmas, or 7s. 6d.; now worth 10s.;—also, the τετραχρυσός, or quarter of the Philipus, of Philip, Alexander, and Lycurgus, weighing forty-five grains, and palled for five drachmas of silver, 1 gu., now worth intrinsically 5s.; and also gold coins of Greece still smaller, and which could not have palled for more than two drachmas of silver.

STATERA ROMANA, or sterleyard, a name given to the Roman balance.

STATES, a term applied to the several orders, or classes, of a people, aslemmed to consult of matters of the public good. See Estate.

STATES-GENERAL, the name of an assembly, consisting, under the former government, of the deputies of the Seven United Provinces.

In this assembly, the deputies of each province, of what number soever they were, had only one voice, and were esteemed as but one person, the votes being given by provinces. Each province prefixed at the assembly in its turn, according to the order settled among them; Guelderland prefixed first, then Holland, &c.

This assembly was the representative of the sovereignty of the Union, which reigned properly in the general assembly of the states themselves of all the several provinces; but a sort of ordinary assembly of seven or eight hundred persons, it was resolved, after the departure of the Earl of Leicester, in order to avoid expense, and the confusion of so numerous a body, that the provincial estates should, for the future, be ordinarily represented by their deputies, under the name of the States-General; who were always to reside at the Hague, and who alone were called states-general.

STATES-GENERAL of France, assemblies which were first called A.D. 1492, and were held occasionally from that period to the year 1614, when they were discontinued, till they were summoned again at an interesting period, viz. in the year 1789. (See France.) These states-general, however, were very different from the ancient assemblies of the French nation under the kings of the first and second race. There is no point with respect to which the French antiquaries are more generally agreed, than in maintaining that the states-general had no suffrage in the palling of laws, and possessed no proper jurisdiction. The whole tenor of the French history confirms this opinion. The form of proceeding in the states-general was this; the king addressed himself to the whole body assembled in one place, and laid before them affairs on account of which he had summoned them. The deputies of each of the three orders, of nobles, of clergy, and of the third estate, met apart, and prepared their "cahier," or memorial, containing their answer to the propositions which had been made to them, together with the representations which they thought proper to lay before the king. These answers and representations were considered by the king in his council, and generally gave rise to an ordinance. These ordinances were not addressed to the three estates in common. Sometimes the king addressed an ordinance to each of the estates in particular. Sometimes he mentioned the assembly of the three estates. Sometimes mention is made of a general assembly of the estates which suggested the propriety of enacting the law. Thus the states-general had only the privilege of advising and recommending; the legislative authority resided in the king alone.

STATES of Holland, an assembly consisting of the deputies of the council, or colleges of each city; in which resided the sovereignty of that province.

Originally, none but the nobility, and the five principal cities, had seats, or voices, in the states. Afterwards they were the deputies of eighteen cities. The nobility had the fifth voices, which were pronounced by the grand peniency, as peniency of their order. The other provinces of the Union had likewise their states, representing their sovereignty, deputies from which made what they called the States-general.

STATESBURG, in Geography, a post-town of South Carolina, and the capital of Clermont county, on the E. tide of Beech creek, which unite with Sharks creek, and discharge itself into the Waceree, a few miles below the town. It contains 10 or 12 houses, a court-house and gaol; 7 miles S. by E. from Camden.

STATES-LAND, a township of Hancock county, in the district of Maine, containing 87 inhabitants.

STATESVILLE, a post-town of Iredell county, in North Carolina; 441 miles from Washington.

STATHEL, in Agriculture, a term sometimes employed to signify any sort of fladle for either corn, hay, straw, or any other kind of farm produce. See STADDLE and STAND.

STATHENI, in Ancient Geography, a people of India, in the number of those who were subjugated by Alexander.

STATHEUSIS, formed of σταθες, I stand, a word used by the old writers to express the torrefaction, or roasting of some medicines before a slow fire, as is done frequently at present with rhubarb, &c.

STATHEUSIS. See STATHOLDER.

STATICAL BAROSCOPE. See BAROSCOPE and BAROMETER.

Statistical is sometimes applied in a peculiar sense to the experiments made as to the quantity of perpiration, and other excretions of the human body.

We have a very particular account of some experiments of this kind in the Philosophical Transactions, No. 427, or Abr. vol. ix. p. 475, made by Dr. John Lining of Charles Town, in South Carolina.

STATICAL Hygroscope. See HYGROSCOPE.

STATICE, in Botany, a name adopted from the Greeks, whole στατίξα is reported to have been so called from ταστικα, to hop, or ares, because of its astringent quality. What the ancient plant may have been, can scarcely be guessed with any probability. The modern application of the name to our Thrift, or Sea-Gilliflower, seems to have originated with Dalechamp, whom Tournefort followed. Hence it has become appropriated to a fine and extensive genus, whose wiry and entangled stems, so well formed to impede the progress of a foot passenger, may literally almost justify its present use.—Linn. Gen. 153. Schreb. 205. Willd. Sp. Pl. v. 1. 1523. Mart. Mill. Dict. v. 4. Sm. Fl. C Brit.
STATICE.


Gen. Ch. Cal. Involutcus different in the different species. Perianth inferior, of one leaf, funnel-shaped; its tube constricted; limb undivided, plaited, membranous, dry, and permanent. Cor. funnel-shaped, of five petals, tapering downwards, combined at the base, dilated upwards, obtuse, spreading. Stam. Filaments five, awl-shaped, shorter than the petals, and inserted into their claws; anthers incumbent. Pist. Germen very minute; stigmas five, thread-shaped, spreading; stigma acute. Peric. Capsule oblong, somewhat cylindrical, membranaceous, with five points, of one cell, splitting at the base only into five valves, clothed with the permanent calyx, and crowned with its flimsy border. Seed solitary, elliptic-oblong. Eff. Ch. Calyx of one leaf, undivided, with a plaited flimsy border. Petals five. Capsule superior, of one cell, of five valves at the base. Seed solitary.

Ob. Limonium of Tournefort, the numerous recently distinguished or discovered species of which now compose the bulk of the genus before us, was characterized by its disfigured, not capitate, flowers.

The species of Statice in the Species Plantarum of Linnaeus are 14; in the last edition of Syll. Veg. 22. Willdenow has 57, to which five are added in the Prodr. Fl. Grec.; and one in Pursh. Three are natives of Britain. They are nearly all perennial, herbaceous, rarely shrubby; natives chiefly of Europe or Africa, two only being found in North America. Their habit is rigid. Leaves simple, mostly radical, generally entire and undivided. Flowers copious, retaining most of their colour and beauty when dried. We shall particularize all the British, as well as the new species, interfering some of the most beautiful or remarkable ones besides.

S. Armeria. Common Thrift, or Sea-Gilliflower. Linn. Sp. Fl. 304. Wild. n. 1. Fl. Brit. n. 2. Engl. Bot. t. 224. (Corps. plurimus; Loh. ic. 452; Ger. Em. 602.)—Stalks simple, capitate. Leaves linear. Awns of the calyx minute.—Native of muddy sea-fluxes, marine rocks, or moist boggy situations on the loftiest mountains, throughout Europe, as well as of the sea-coast of North America, flowering in July and August. Light-foot well denominates it, for this reason, "the most humble and moist lofty of plants." It also bears the smoke of London better than most plants, and from its thriving in almost any situation, has obtained the name of Thrift. It often serves for edgings in country, as well as town gardens. The woody root bears thick tufts of lax, linear, channelled, smooth, deep-green leaves. The stalks are about a span high, simple, round, each invested, at their first protrusion, by a tubular membrane, soon torn from its base, and carried up along with the terminal round head, of numerous, pink, inodorous flowers, whose base is surrounded with an involucrum of many leaves, in three rows. The permanent calyx is of a pale shining brown, or nearly white, its points tipped with five minute, scarcely rough, awns. We are not satisfied that the larger plant, made the leading variety in Willdenow and Aiton, and figured likewise in Lobel's Icones 452, may not be a different species; perhaps the following.

S. Albancz. Garlick-like Thrift. Cavan. Ic. v. 2. 6. t. 109. Wild. n. 3. Sm. Fl. Grec. Sibth. t. 394, unpublished.—Stalk simple, capitate. Leaves linear-lanceolate, somewhat three-ribbed. Awns of the calyx rigid, rough.—Found by Cavanilles on various mountains of Spain, and by Sibthorp on Mount Athos and Hyemetus. The herbage is larger than the leaf; the leaves more or less lanceolate. Heads of flowers hardly so large, entirely white in the Greek, as well as Spanish, specimens; the calyx having in those of Dr. Sibthorp a hairy tube, not described by Cavanilles: its awns are elongated and rough.

S. Limonium. Common Sea-Lavender Thrift. Linn. Sp. Fl. 394. Wild. n. 6. Fl. Brit. n. 2. Engl. Bot. t. 192. Fl. Dan. t. 93. (Limonium, et L. Pentanum; Ger. Em. 411.)—Stalk panicled, round. Leaves obovate-lanceolate, smooth, without ribs, tipped with a decurrent awn.—Common about muddy sea-fluxes throughout Europe, from Sweden to Greece, flowering in July and August. (See Limonium.) This species varies greatly in size and luxuriance, or perhaps some of its reputed varieties ought to be considered as distinct. Usually its leaves are three or four inches long and one broad, tapering downwards, leathery, somewhat waved, very smooth, rather glaucous. Stalk near a span high, hard and rigid, panicled, bracteate, its branches ending in close imbricated spikes of hand-to-meet blue flowers, whose calyx is pale pink in a recent flate, white when dry, deciduous of awns; its tube closely enveloped in a fount, feathering, membranous-edged involucrum, of a fiddle leaf.

S. caroliniana. Carolina Sea-Lavender Thrift. Walt. Carol. 118. Pursh n. 2. "Stalk round. Panicule much branched, divaricated. Calyx acute. Leaves lanceolate-oblong, bluish, smooth, flat-edged."—In salt-marshes along the sea-coast, from New Jersey to Carolina, flowering in August and September. Flowers blue. Pursh. We are not certain of having seen this species, which Linnaeus appears to have confounded with the last. Mr. Walter observed the separation of the capsule into five valves at the base; a character of Jullien's Plumbaginies. See that article.

S. bellidiformis. Daily-leaved Thrift. Sm. Prodr. Fl. Grec. Sibth. n. 733. Fl. Grec. t. 295, unpublished.—Stalk panicled, round. Leaves obovate-lanulate, abrupt, smooth. Calyx bluish, without awns.—Gathered by Dr. Sibthorp, on the shores of Rhodes, and several islands in the Archipelago. The root is woody, crowned with large tufts of spreading, green, abrupt or emarginate leaves, an inch or inch and half long, convex at the edges, very smooth. Stalk a foot high, panicled copiously nearly from top to bottom, rather zigzag. Flowers purple, loosely spurred. Calyx with a hairy tube, and white limb, with five brown ribs. Petals emarginate.

S. globularifolus. Globularia-leaved Thrift. Desfont. Atlant. v. 1. 274, by the description. Sm. Prodr. Fl. Grec. Sibth. n. 734. Fl. Grec. t. 296, unpublished. (Limonium medium, globularia folio; Barrel. Ic. t. 793, 794.)—Stalk panicled, round; with level-topped branches. Leaves obovato-lanulate, pointed, smooth. Calyx acute. —Native of Barbary and Sicily, by the sea-faede. The leaves are more glaucous than in the last, somewhat bordered, acute, and tipped with a sharp point. Branches of the panicle shorter, more dense and level-topped. Flowers rather smaller, and of a lighter purple. Calyx hairy, and similarly coloured, but the segments of its limb much narrower, more taper and acute. The common flower-stalk does not begin to branch so near the base, nor is it so fount.

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turned upwards. Calyx bluntish. Leaves spathulate, obtuse, pointless, smooth, glaucous.—Native of the coast of Barbary. Flowered in August 1811, in the garden of Mr. W. Pringle at Sydenham. Mr. Aiton marks it as introduced in 1804. This differs from the leaf in having blunt leaves, without points, in which respect it also differs from S. limonium, and a reputed variety thereof, found on the coast of Brittany, which leaf is perhaps Barrarer’s t. 790, and very nearly accords with our present plant, in its crowded spikes of flowers twice the size of the leaf, and a much less branched stalk. We have not been able to ascertain how far this and Vahl’s auriculatula, Wild. n. 12, are distinct. Specimens from Narbonne, supposed to be the latter, agree in every thing with the figure of spathulata, except in having a point to the leaf.

S. laticolla. Broad-leaved Thrift. Sm. Tr. of Linn. Soc. v. 1. t. 350. Wild. n. 9. Ait. n. 7. (Limonium folio Eunala, fabellis tenusfima ramosissima, floribus parvis caruleis ; Gerber’s M.S.) —Stalk panicled, very much branched, rough. Leaves downy, with minutely flarly hairs. Calyx somewhat pointed, without awns. —Native of Russian Tartary, on the banks of the Don, near Aphi. It flowered in Sinn gardens, under the care of Mr. Hoy, in 1788, as mentioned in the Linnean Tranfections, so that the date of 1791 in Hort. Kew. is an error, though the name of Mr. Bell, as the introducer of the plant, is probably right. This species is distinguished by the great size of its oblong leaves, a foot or more in length, borderless with flarly tufts of soft hairs, and the vast profusion of its small blue flowers, which compose a spreading, rather level-topped, panicled, often two feet wide. It is a hardy perennial, flowering from May to July. Willdenow gives as a synonym S. corysia, Pallais Ind. Fl. Taur. and remarks that the lower branches are barren, as in S. reticulata and others. This is not very evident in our specimens, though it may possibly be so.

S. oleifolia. Olive-leaved Thrift. Sm. Prodr. Fl. Gracc. n. 735, excluding probably the synonym of Willdenow. (Parvum Limonium parvum oleofolium; Lob. t. 295. Limonium parvum; Ger. Em. 411.) —Stalk panicled, round; its lower branches barren. Leaves oblong-spatulate, obtuse, smooth, with scarcely any point. —Native of the sea-coasts of the south of France, Italy, and Greece. The roots are woody and tufted. Leaves an inch or inch and half long, not above a quarter of an inch broad in any part; tapering at the base; minutely dotted on both sides; a little hooked, or reflexed, but not awned; at the extremity. Stems a foot high, or more or less, roughish; their branches copious, zigzag and somewhat divaricated, about half of them naked and barren; the upper ones bearing level-topped, rather lax, spikes of slender flowers, all turned one way. Tube of the calyx slender, hairy; the segments of its limb ovate, acute, awnless.

S. dichotoma. Many-forked Thrift. Cavan. l. c. v. 1. t. 37. t. 50. Sm. Prodr. Fl. Gracc. n. 736. (Limonium minus oleifolium, var. pisi ; Barrrel. l. c. t. 790.) —Stalk erect, panicled; its branches rough with points; the lower ones barren, in many capillary segments. Leaves obovate, smooth. —Native of Spain, about two miles from Madrid, according to Cavanilles. Dr. Sibthorp found it in Greece. The leaves are four times as large as the leaf, and perfectly obtuse. Stems eighteen inches high; its lower branches repeated and minutely forked, almonlike with S. reticulata, but not prostrate. Inflorescence like the leaf. Calyx with a hairy tube. Flowers pale blue. Willdenow quotes Barreller’s t. 790 for his L. oleofolia; a species whose branchlets are described as angular and winged, and which, therefore, does not answer to Scopoli’s oleofolium. Del. Infub. v. 1. t. 10, nor are we able to determine what Willdenow intended. S. reticulata. Matted Thrift or Sea-Lavender. Linn. Sp. Pl. 594. Wild. n. 16. Fl. Brit. n. 3. Engl. Bot. t. 538. Hill Fl. Brit. t. 35. f. 2. —Stalk prostrate, panicled, zigzag; its branches rough with points; the lower ones barren. Leaves wedge-shaped, rather acute, without points. —Native of falt-marshes on the north coast of Norfolk, flowering copiously in July and August. It is also found in the south of Europe. This is smaller than the last, and differs in having the stems quite prostrate, their branchlets much flouter, matted and entangled together. Flowers light purple, few in each spike. Calyx hairy below. Willdenow makes the preceding a variety of this, nor can we be positive of the contrary.

S. palmari. Humble Frosted Thrift. Sm. Prodr. Fl. Gracc. n. 737. Fl. Gracc. t. 207, unpublished. —Rough with hoary dots. Stalk panicled, round, erect, and rather close. Leaves spathulate, obtuse. —Gathered by Dr. Sibthorp on the seacoast of Afla Minor. The roots is woody, crowned with many tufts of numerous spreading leaves about an inch long, frosted as it were, and rough with tubercles, like the whole herbage. Stems many, three or four inches high, composed of four or five alternate, erect, simple, lax spikes of handsome pink flowers, without any branch or forked branches. The calyx is smooth, brown, with short ovate segments.

S. echinoides. Bugle-leaved Thrift. Linn. Sp. Pl. 394, excluding Magnol’s synonym. Wild. n. 17. Ait. n. 13? Fl. Gracc. t. 298, unpublished. —Rough with hoary dots. Stalk panicled, round, jointed, very much branched, zigzag, divaricated. Leaves spathulate. —Native of the shores of Cyprus and Crete. The roots is very strong and woody, crowned with many rote-like tufts of frosted leaves, much like the last. The flowers, however, are very different, a foot or more in height, bulky, repeatedly branched, stout, and strongly divaricated, almost at right angles. Spikes very zigzag and lax. Flowers light purple. Calyx with a hairy tube, and white obtuse limb, whose segments are very shallow. Linnneas confounded this with the following, which he appears to have known from Magnol’s work only.

S. ariflata. Awned Annual Thrift. Sm. Prodr. Fl. Gracc. n. 739. Fl. Gracc. t. 299, unpublished. (Limonium minus annuum, bullatis foliis, vel echinoides ; Magn. Montp. 107. t. 156. Tourn. Infl. 346.) —Stalk panicled, round, dotted; its branches loosely spiked. Leaves oblong, round, rough. Calyx of the fruit awned. —Native of the sea-shores of the south of France, and island of Cyprus. The root is simple, small, and annual. Leaves several, radical, an inch or two long, green, rough with tubercles. Stalks several, from six to twelve inches high, erect, branching from near the bottom into numerous long, slender, spreading, lax spikes of small pink flowers. Calyx with a smooth tube; its membranous limb so delicate, that it soon leaves the strong brown rib, in the form of naked awns.

S. speciosa. Plantain-leaved Thrift. Linn. Sp. Pl. 395. Wild. n. 13. Ait. n. 14. Curt. Mag. t. 656. (S. n. 15; Gmel. Sib. v. 2. 221. t. 91. f. 1.) —Stalk panicled; its branches angular and somewhat winged. Flowers crowded. Bracts dilated, pointed, longer than the blunt crenate calyx. Leaves obovate or lanceolate, pointed. —Frequent throughout Siberia, in open, dry, hilly places. Gmelin. Sometimes seen in our gardens, but seldom long preferred. The root is marked, as before, with a smooth tuberoth to the touch, usually about two inches long and one broad. Stalk from six to eighteen inches high, erect;
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Simpie, naked, and almost round, in the lower part; but terminating in a large, angular-branched, dense panicle, of handsome pink flowers. General and partial bractee ovate with a sharp point, the latter most dilated and membranous at the edges. Tube of the calyx hairy, concealed, like the flat-tish involucrum, by the bractees; its limb white, membranous, obtuse, crenate, not lobed, nor awned.

S. rofafa. Curr. Mag. t. 59. appears to us, without any doubt, a variety of this with narrow leaves; there being in reality no material difference in the bractees.

S. arboresc. Tree Thrift. — Stem arborescent, leafy. Leaves obovate, stalked. Flower-flasks panicked; their branches angular and winged. Flowers crowded. Bractees ovate, sheathing, much shorter than the involucrum.—Gathered on the maritime rocks at Buracao and Rambla in the isle of Teneriffe, by Mr. Maffon, whole specimen, given to the younger Linnaeus, is marked "Statice arboresc. of Selandier!" but we find nothing published under this name.

The Spaniards call the plant Siganisporia del mar. The stem is said to be arborecente, fix feet high. The branches are round, woody, one-third of an inch in diameter, scarred with the crowded bases of old footflasks, resembling thin annular filipulas. Leaves fix or eight at the end of each branch, spreading every way, two or three inches long, and about half as broad, obtuse, smooth; wavy at the edges; tapering at the base into a rigid angular footflask, dilated and clasping the stem at the bottom. Flower-flasks terminal, solitary, root or more in length, compressed and winged, bearing a very large compound corymbous panicle, of innumerable crowded flowers, whose partial flasks are dilated into a wedge-shaped, leafy, two-lobed form. Bractees short, ovate, membranous, the partial ones in pairs, sheathing the base of the involucrum, which is twice their length, involute, coriaceous and ribbed, resembling that of S. Limonium and its allies. Tube of the calyx smooth, concealed in the involucrum; limb of a delicate light permanent blue, in the dried specimen, spreading, with five red ribs, and as many shallow lobes. We can discover nothing of the colour of the corolla.

This noble plant would be a great acquisition to our greenhouse.

S. Echinus. Prickly Mountain Thrift. Linn. Sp. Pl. 395. Willd. n. 20. Fl. Grac. t. 300, unpublished. (Echinus, id ef Tragacantha altera; Alpin. Exot. 57. t. 56. Limonium cetipetorum, foliis aculeatis; Buxh. Cent. 2. 18. t. 10.)—Branches clothed with awl-shaped, spiny leaves. Flowers somewhat spiked.—Found by Buxbaum in the deserts of Media, flowering in July. Dr. Sibthorp gathered it on the Sphacitei mountains of Crete, as well as on the Bithynian Olympus. The long and woody black root is crowned with dense tufted leafy flms and branches, two or three inches high. Leaves about an inch long, spreading every way, rigid, linear, channelled, smooth, entire, with a spinous point. Flowers of a bright pink, very beautiful, three or four together, in terminal, solitary, nearly fifele, spikes. Invoucurnm of two spreading pointed leaves. Calyx white, with five brown ribs, a smooth tube, and a pentagonal, scarcely lobed, border. Such indeed is the alpine plant, found by Alpinus and Sibthorp. The flower-flask in the figure of Buxbaum is elongated, naked, and somewhat branched, a span long; but the Linnean specimen, intermediate between the two, prove this to be a mere variety, owing to situation. It is pity this elegant species is unknown in gardens.

S. purpurata. Purple Cape Thrift. Linn. Mant. 59. Willd. n. 22. Thurb. Prod. 54. (S. peregrina; Berg. Cap. 801.)—Stem shrubby, leafy. Leaves obovate-wedge-shaped, three-ribbed, stalked, pointed, smooth. Panicle level-topped; its branches roughish, somewhat angular, without wings.—Native of the Cape of Good Hope. The habit of this plant approaches that of our last species but one, S. arboresc., but its stipe is less. The stem is shrubby, with round, smooth, woody branches, leafy towards their extremities. Leaves scattered, rounded, obtuse or emarginate, with a small point; smooth on both sides, with three brown equal ribs; tapering down gradually into a rigid footflask, whose dilated membranous, sheathing base surrounds the stem. Each leaf is about two inches long; the footflask about half as much. Panicle corymbose and level-topped; its branches quite defilite of wings, rough with minute points; the ultimate ones zigzag and most angular. Bractees roundish-ovate, acute, with a membranous edge. Flowers not very numerous. Calyx with a hairy tube, and broad, membranous, purple border, which is very slightly angular rather than lobed. Corolla purple. Bergius's description hardly answers to the Linnean plant, except perhaps what he lays concerning a variety. S. schiedeis has no resemblance to karputata.

S. rofafa. Rose-coloured African Thrift.—Stem shrubby, leafy. Leaves obovate-oblong, single-ribbed, stalked, pointed, rough on both sides. Branches of the panicle rough, somewhat angular, without wings. Flowers crowded.—We are obliged to Sir Samuel Young, bart. of Formosa, Berks, for specimens of this beautiful species, gathered at St. Helen's bay, on the coast of Africa. Its stem, shrubby habit, and leafy branches, agree with the last; but the roughness of the whole plant, and particularly both sides of the leaves, with minute tubular points, the want of lateral ribs in the foliage, and the far more abundant, crowded flowers, whose permanent calyx is roser-coloured, rather than purple, induce us to consider it as distinct. The tubular riblets involucrum, with two short sheathing membranous-edged bractees at its base, is the same in both these species.

S. monopetala. Sicilian Shrubby Thrift. Linn. Sp. Pl. 396. Willd. n. 27. Ait. n. 20. (Limonium linumaria, &c.; Bocc. Sic. t. 16, 17.)—Stem shrubby, leafy. Leaves lanceolate, fleshy, fleshy, with sheathing flasks. Flowers diffusely spiked. Corolla monopetalous; its tube longer than the calyx.—Native of uncultivated ground in Sicily, as well as the south of France. It is not an unfrequent greenhouse shrub, flowering in July and August. Boccone says the red woody root is sometimes thicker than a man's leg. The flms are bulbous, but diffuse, unless artificially supported. Leaves numerous, obtuse, an inch or two long, various in breadth, thick, ribles, glaucous and minutely scaly all over, tapering down into a footflask, whole base is cylindrical and sheathing. Flowers large, pink, in solitary or aggregate lax spikes. Invoucurnm very hard and tight, nearly concealing the calyx and its small border. Claws of the petals combined.

S. sinuata. Scallop-leaved Thrift. Linn. Sp. Pl. 396. Willd. n. 34. Ait. n. 22. Curt. Mag. t. 71. Fl. Grac. t. 301, unpublished. (Limonium foliis foliati; Ger. 412.)—Stem herbaceous, winged. Radical leaves falcate; those of the stem awl-shaped, decurrent, three in a whorl. Calyx undivided, without awns.—Native of Sicily, Barbary, and Palestine. Dr. Sibthorp found it very frequent on the inundated shores of the Greek islands, and suspected it might be the real \\nu\\nu\\nu\\nu\\nu\\n. The modern Greeks call it \"evdoukia.\" In gardens it has been known ever since the days of Parkinson, but seldom endures long, even in a greenhouse. The numerous radical leaves are pinnailed, with numerous rounded lobes, green, obtuse, and hairy, three or four inches long. Stems de-
cumbent, a span long, branched, with leafy wings, and
whorls of narrowly acute leaves, about an inch in length.
Flowers crowded, in level-topped hairy tufts, all turned
upwards. Leaves of the involucrum three-pointed.
Limb of the calyx cup-shaped, undivided, of a delicate lilac-
purple, elegantly contrarcted with the pale yellow mono-
petalous corolla. The latter, however, soon passes away,
the calyx only retaining its form and colour when dry.
Martyn, in his Hist. Plant. Rat. t. 48, exhibits a variety
of this plant, whose leaves are but partially finnated.

**S. canescens.** Wedge-shaped Thrift. (S. finnata; Linn.
Sp. P. 397. Limonium caucubis alatis, alpeil folis
manibus asperis, calycibus acuto floribus flavoCentibus; Shaw
Afr. n. 367.)—Stems herbaceous, winged, leafless.
Leaves radical, somewhat finnated. Calyx acutely five-leaflet,
awned.—Gathered by Shaw in Barbary, where, as he tells
us, the Arabs call it El Khaddak; and by Haifeliquit in
Palestine. We cannot but consider this as a distinct species,
on account of its nearly smooth herbage, want of flimen-leaves,
and the greatly dilated wedge-shaped bracteat, much more
conspicuous than in the lath. The involucrum moreover is
of a much firmer texture with rigid, recurved, spinous
points; but above all the yellowish, not purple, limb of the
calyx has five acute lobes, the strong ribs of which, soon de-
nated, as in our S. arifata, become recurved brilliantly awns.

**S. lobata.** Lobed Spinosus Thrift. Linn. Suppl. 187.
Willd. n. 35.—Stems herbaceous, without wings. Leaves
radical; finnated. Calyx undivided, without awns.—Na-
tive of Barbary. This species is hardly known, except in the
Linncean herbarium. The specimen came from Moro-
cco. The root is simple, long and taper, apparently an-
nual. Leaves all radical, an inch and half long, hairy,
much like those of S. finnata. Stalks round, three or four
inches long, decumbent, panicled, with a spiky-shaped leaf
or two at their divisions. Bracteatas wedge-shaped and de-
current, as in the lath, but much smaller, and rough at the
edge with hooked prickles. Leaves of the involucrum
rough with long, spinous, spreading points. Limb of the
calyx white or yellowish, like the lath; but entire and
without awns, like S. finnata.

**S. muricata.** Curled Thrift. Linn. Suppl. 187.
Willd. n. 47.—Stem branched, winged with a triplicate
crisped border. Leaves radical, ovate, pointed. Flowers
spiked, crowded, all turned one way.—Native of the coast of Barbary, flowering
in July. Sometimes kept in greenhouses. The partly
decumbent flimen are much branched, and remarkable for
their crisped, not very broad, wings. Leaves on longish
footstalks, ovate, but tapering at the base, slightly wavy
at the margin, rather glaucous or scaly. Flowers blue-
purple, crowded, in aggregate level-topped spikes. Bracteatas,
as well as involucrum, reddish, obtuse,pointed, concave,
not keeled; their margins broad and membranous. Limb
of the calyx scarcely pentagonal, neither lobed nor awned.
A very distinct species, unlike any of the rest.

**STATICE.** In Gardening, comprehends plants of the hardy,
herbaceous, and under-shrubby kinds, of which the species
cultivated are, the thrift, or sea-gillyflower (S. armeria); the
sea-thrift, or sea-lavender (S. linorum); the heart-
leaved sea-lavender (S. cordata); the matted sea-lavender (S. reticulata); the rough-leaved sea-lavender (S. echioides);
the plantain-leaved sea-lavender (S. speciosa); the Tart-
tarian sea-lavender (S. tartareca); the triangular-leafed
sea-lavender (S. spinifolia); the narrow-leaved shrubby sea-
lavender (S. stethroica); the broad-leaved shrubby sea-
lavender (S. monopetalus); the cut-leaved sea-lavender
(S. ferulacea); and the scollop-leaved sea-lavender (S. finnata).

In the first fort there are several varieties: as with red
flowers, with scarlet flowers, with white flowers; great
thrift with red flowers, with white flowers; and small fea-
pink, with flesh-coloured flowers.

The second species has also several varieties: as common
great sea-lavender, great late-flowering sea-lavender, olive-
leaved sea-lavender, deep blue-flowered sea-lavender, and
white-flowered sea-lavender.

In the twelfth or last fort there are two varieties, which
differ in their leaves, flimen, and flowers.

**Method of Culture.—** All the sorts of these plants are capa-
bile of being increased by planting or by the roots. This,
with the first kind, should be performed in the autumn,
or very early spring season, planting them immediately as
edgings, or in the borders: they should not, however, be
parted too small. And when planted out as edgings, a quan-
tity of slips should be obtained in these edgings from old
plants, by planting or dividing the off-sits of their roots,
each slip being furnished with roots and tops; then, having
made up the edge of the bed or border even and firm, plant-
ing them either with a dibble in one range, two or three
inches distance in the row; or to form once a close edging,
so near as to touch one another, or in a small trench or
close, as in planting box-edgings. These edgings should,
every summer, immediately after flowering, be trimmed
with garden-hoes, or a knife, to cut off all the decayed
flower-talcs close to the bottom; likewise to trim in any
projecting irregularity of the edging, at the sides or top;
also, when it spreads considerably out of the bounds, it should
be cut in evenly, on each side, in due proportion; per-
forming those trimmings in moist weather, and not too late
in the autumn, otherwise the drought of summer, or the cold
of winter, will be apt to injure them when newly cut, and
cause them to have a shabby disagreeable appearance.

When these edgings grow considerably out of bounds, or
become very irregular, it is necessary to take them up, slit
the plants small, and immediately replant them as before,
in a neat regular edging. They sometimes require replanting
every three or four years in this manner.

The second sorts may likewise be increased by parting
the roots in the autumn or spring, preferring some mould
to be set on them and planting them out again immediately, being
placed in an east border, where the soil is loamy.

They may also be raised from seeds obtained from abroad,
fowing them on a similar border, keeping the plants clean;
and when of sufficient growth, planting them out in pots.
It is the common practice, in treating the second fort, ac-
cording to Martyn, to consider it as a greenhouse plant;
and it appears to the greatest advantage in a pot, as it is
much disposed to throw up new flowering-flomen. By hav-
ing several pots, some plants will be in flower throughout
the summer: on this account, and for the fineness of its
large blue calyx, it is a plant that merits attention. The
echioides is also a greenhouse plant.

The eighth, ninth, tenth forts, &c. may be increased by
planting cuttings of the young shoots, in July, in a shady
border, watering them frequently. When the plants have
a little growth, they should be taken up, and placed in
separate pots, filled with light loamy mould, putting them
in the shade till re-rooted. The plants of these sorts must
be removed into shelter in the autumn; but they only re-
quire protection from hard frosts, of course may be placed
with myrtles, and other hardy greenhouse plants, where
they often continue to flower a great part of winter, and
make a pretty variety. These sorts afford ornament among
other potted more hardy greenhouse plants, and produce a
pleasing diversity. All the other common sorts are useful
in increasing the variety, when planted out in the common
ground,
ground, in a rather funny situation, where they generally lack the longest.

**Staticks,** Staticks, formed of Στιξ, I weigh, a branch of mathematics, which considers weight or gravity, and the motion of bodies arising from it.

Those who define mechanics the science of motion, make statics a subordinate part of it; eis, that part which considers the motion of bodies arising from gravity.

Others make them two distinct doctrines, refining mechanics to the doctrine of motion and weight, in reference to the structure and power of machines; and statics to the doctrine of motion, considered merely as arising from the weight of bodies, without any immediate respect to machines. On which footing, statics should be the doctrine or theory of motion; and mechanics, the application of it to machines.

For the laws of statics, see Gravity, Desert, &c.

**Staticks,** Statics, in Medicine, a kind of epilepsies, or persons seized with epilepsies.

Staticks differ from catalepsies, in that these last have no sense of external objects, nor remember any thing that passes at the time of the paroxysm; whereas the statics are all the while taken up with some very strong, lively idea, which they remember well enough when out of the fit.

**Staticula,** among the Romans, those little figures with which it was usual to adorn their drinking cups, called joppis.

**Staticuli,** among the Romans, a kind of dancing pantomimes. See Pantomime.

**Station,** in Geometry, &c. a place pitched upon to make an observation, take a triangle, or the like.

An inaccessible height, or distance, is only to be taken by making two stations, from two places whose distances are known. In making maps of provinces, &c. stations are fixed on all the eminences, &c. of the country, and angles taken thence to the several towns, villages, &c.

In surveying, the instrument is to be adjusted by the needle, to answer the points of the horizon at every station; the distance from the last station to be measured, and an angle to be taken to the next station; which includes the whole breadth of surveying.

In levelling, the instrument is rectified, that is, it is placed level at each station, and observations made forwards and backwards.

We have a method of measuring distances at one station in the Philosophical Transactions, No 7, by means of a telescope. But the practice of this method does not answer to the theory.

**Station,** Line of, in Perspective. See Line.

**Station,** in Acronomy, the position or appearance of a planet, in the same point of the zodiac, for several days. As the earth, whence we view the motions of the planets, is out of the centre of their orbits, the planets appear to proceed irregularly; being sometimes seen to go forwards, that is, from west to east, which is called their direction; and sometimes to go backwards, or from east to west, which is called their retrogradation.

Now between these two stations there must be an intermediate one, in which the planet neither appears to go backwards nor forwards, but to stand still, and keep the same place in her orbit; which is called her station.

**Station,** in British History. The stations, or stations, fortresses erected along the line of Severus's wall, were so called from their stability, and the stated residence of garrisons. They were also called ephires, a name which many of them still bear. These were by far the largest, strongest, and most magni-

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<tr>
<th>No.</th>
<th>Latin Name</th>
<th>English Name</th>
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<td>Newcastle</td>
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<td>Hunnum</td>
<td>Halton-chevetes</td>
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<td>Cinsturn</td>
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<td>Borovocivus</td>
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<td>Boulineis</td>
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Length of the wall 68 3 3

See Wall.
STA

Station, Statio, in Church History, is applied to the fall of the fourth and sixth days of the week, that is, Wednesday and Friday; which many among the ancients observed with much devotion, till three of the clock in the afternoon. St. Peter of Alexandria, in his Canonicall Epistle, can. 15, observes, that it was appointed, conformably to ancient tradition, to fall weekly on those days; on Wednesday, in memory of the council the Jews took to put our Saviour to death; and on Friday, on account of his passion. Some regard to which is still had by the church of England. See Abstinence.

Station is also used in the church of Rome, for a church where indulgences are to be had on certain days.

It was St. Gregory that fixed the stations at Rome, i.e. the churches where the office was to be performed each day of Lent, and on solemn fast-days. These stations he marked down in his Sacramentary, as they now stand in the Roman Missal; appropriating them chiefly to the patriarchal and titular churches; but though the stations were fixed, the archdeacon did not fail, at each station, to publish to the people the following station.

Station is also a ceremony in the Romish church, in which the priests or canons go out of the choir to sing an anthem before the crucifix, or the image of our Lady. This ceremony is ascribed to St. Cyril.

Station, Statio, ranx, in the Ancient Music, was sometimes used for any fixed pitch, or degree of sound, whether produced by intonation or semitone.

Station-Line, in Surveying. See Line and Surveying.

Stationa, in Ancient Geography, a town of Italy, in the interior of Etruria, according to Strabo.

Stationarium, were men, thus called in the middle ages, who trafficked in books, made large fortunes by lending them out to be read, at exorbitant prices, not in volumes, but in detached parts, according to the estimation in which the author was held.

Stationary, in Astronomy, the state of a planet when it seems to remain immovable in the same point of the zodiac. The planets having sometimes a progressive, and sometimes a retrograde motion, there will be some point in which they appear stationary. Now a planet will be seen stationary, when the line, that joins the earth's and planet's centre, is confluently directed to the same point in the heavens, that is, when it keeps parallel to itself. For all right lines drawn from any point of the earth's orbit, parallel to one another, do all point to the same star; the distance of those lines being insensible, in comparison of that of the fixed stars.

Saturn is seen stationary at the distance of somewhat more than a quadrant from the sun; Jupiter at the distance of 52°; and Mars at a much greater distance; Venus at 47°, and Mercury at 28°.

Saturn is stationary eight days, Jupiter four, Mars two, Venus one and a half, and Mercury a half; though the several stations are not always equal; because the orbits of the planets are not circles, which have the sun in their centre.

Stationary Fevers, an hypothetical term, used by Sydenham to denote those fevers which continue to prevail through a certain number of seafasts, as connected with some particular constitution of the atmosphere, according to his supposition; and giving a particular epidemic character to the maladies of those seafasts; and as contrasted with those casual and short occurrences of particular diffeases, which are now and then intermixed with the prevalent epidemics, and which he denominated intercurrent fevers. (See Sydenham, Observat. Medicæ circa Morb. Acut. Historiam et Curat. sect. i. c. 2., and sect. vi. c. 1.) Although he was able to trace several successive changes in epidemic constitutions, or stationary fevers, at different periods of his practice; he is compelled to admit, that these changes could not be ascribed to any sensible variations of the atmosphere, such as heat and cold, dryness and humidity; and adopted, therefore, the idea of occult and inexplicable contamination in some occult and inexplicable contamination of the air by certain effluvia from the bowels of the earth. See Sydenham.

Stativa, among the Romans, a standing camp kept for the defence of the frontiers of the empire. These camps gave rise to a great many towns, which took their names from the legion stationed there.

Statius, Publius Papinius, in Biography, an eminent Roman poet, was born at Naples, in which city his father was settled as a teacher of oratory, and was in great reputation both for his lectures and poetry, in which he gained several prizes. Statius was born probably about the year A.D. 61. He early displayed a lively disposition and good talents, and soon became a votary of the muses with so much success, that during his father's life he obtained the crown in the poetical contests of his native place. He was thrice a victor in the poetical games celebrated at Alba. The poems which he addressed to several of the principal persons in Rome, are proofs of the friendship which he contrived with men of rank in that city; and a piece, which he recited in the quinquennial games instituted by Nero, and renewed by Domitian, procured for him a golden crown from that emperor, and the honour of admission to his table. He was exquisitely at a contest in the Roman games, on which occasion he recited a part of his principal work, the Thebaid. According to Juvenal, he was heard with delight by a crowd of auditors in other public recitations of this poem: the fatality at the same time intimating, that notwithstanding this applause, the author might have starved, had he not sold his "Agave," apparently a new composition, to a celebrated actor, a favourite of Domitian. He possessed a small estate and country house near the site of the ancient Alba, and lived in a decent state of mediocrity. Having no children of his own, he adopted a son, whose death he tenderly laments in one of his miscellaneous poems. The time of his own death is not known; but it is thought to have been about the year 96, when he was only 35 years of age. He is not even mentioned by any contemporary poet, except Juvenal. Martial, who celebrates many other poets, takes not the least notice of him. The existing works of Statius consist of the "Sylvae," or miscellaneous pieces, in five books; the "Thebaid," an epic poem, in twelve books; and two books of an unfinished poem, entitled "Achilles," "They all," says his biographer, "display a considerable share of genius and real talent, but are vitiated by the false taste which then began to infect Latin poetry, and gave a turn to turgid and unnatural thoughts and expressions. Several pieces in the "Sylvae" are, however, pleasing and elegant.

His principal work, the "Thebaid," holds no mean rank among epic poems, and once it was a great favourite among the remains of antiquity. For this preference it was indebted to its swelling sentiments, verging to bombast, and to the savage and sanguinary character of its incidents, which fudged the times of chivalrous turbulence. But with these faults it exhibits strokes of the real sublime, and considerable force and novelty in natural description, especially in the families." The best editions are those of Calpur Barthus, 4to. 1664; of Vossius, Lug. Bat. 8vo. 1671; and
and the Delphin, 2 vols. 1689. Markland’s edition of the “Silvano” is highly esteemed.

**STATO della Chiesa, State of the Church, or Papal dominion, is given to the dominions of the pope in the central part of Italy. These dominions were bounded on the N. by the Venetian States, on the E. by the Adriatic and part of the kingdom of Naples, on the S. by the Mediterranean, and on the W. by the Mediterranean, the duchy of Tuscany, and the duchy of Modena; and consisted of several states or provinces. See Ecclesiastical State.**

The peculiar power of the popes is traced back to the age of Pepin and Charlemagne; and the forged collection of papal receipts, published in the 9th century under the name of Iulianus, led to successive accumulations of dominion. The small territory, granted in the eighth century, was increased by the acquisition of Benevento in the eleventh, after which there was a pause; and the popes themselves were constrained to reside at Avignon. In 1513 Bologna was acquired by Julius II.; the marquise of Ancona followed in 1532; Ferrara in 1598; and Urbino in 1626. But since the French revolution, the temporal power of the pope was annihilated by Bonaparte (see Italy); and again restored after the expulsion of the French emperor. When the temporal power predominates, not great industry can be expected, and the soil is not likely to derive much accession to its natural fertility from cultivation. The principal, and, indeed, almost the only exports from the Papal states, are superior kind of alum, prepared from a whitish argillaceous rock at Tufa, near Civita Vecchia, from which place also is exported punica (which see). The chief city of the papal territory is Rome (which see); and its revenue has been computed at about 350,000l. sterling; but by exertions in foreign countries it is laid to have been raised to 500,000l. subject, however, to a large debt, being 8 per cent. interest; and this strikingly evinces a defect of industry and prosperity. See Ecclesiastical State, Italy, and Popes.

**Statuto de Gli Prestiti, a name given to a part of Tuscany, which was ceded to Philip II. king of Spain, and belongs to Naples. It is situated on the coast of the Mediterranean, and confines of the towns of Orbitello, Porto Hercule, the principality of Fiuminana, and the island of Elba, with a few villages. By the peace signed at Florence, between the king of Naples and the French republic, this country was given to France. See Naples and Tuscany.**

**STATORES, among the Romans, made a part of the emperor’s life guard.**

**STATURAL, Statuaria, a branch of sculpture, employed in the making of statues.**

Statuary is one of those arts in which the ancients surpassed the moderns; indeed it was much more popular and more cultivated among the former than the latter. It is disputed between statuary and painting, which of the two is the most difficult, and the most artful. See Sculpture.

The invention of statuary was at first very coarse. Leon Battista Alberti, who has an express treatise on statues, imagines, that it took its rise from something casually observed in the productions of nature, that, with a little help, seemed dipole to represent the figure of some animal. The common story is, that a maid, full of the idea of her lover, may by the influence of her father’s implements, who was a potter. This, at least, is pretty certain, that earth was the first matter upon which statuary was practised.

**Statuary is also used for the artificer who makes statues. Phidias was the greatest statuary among the ancients; and Michael Angelo among the moderns.**

**Statuary Column. See Column.**

**Statuary Fountain. See Fountain.**

**Statuary Marble, among our artificers, the name of the softer white marble usually wrought into statues, the same with the Parian marble of the ancients.**

**Statue, Statua, a piece of sculpture in full relief, representing a human figure.**

Daviler more scientiﬁcally deﬁnes statue, a representation in high relief, and insulare, of some person distinguished by his birth, merit, or great actions; placed as an ornament in a fine building, or exposed in a public place, to preserve the memory of his worth.

In strictness, the term statue is only applied to figures on foot; the word being formed from the Latin statum, the size of the body; or from stas, to stand. Statues are formed with the chisel, of several matters, as stone, marble, plaster, &c.

They are also cast of various kinds of metal, particularly gold, silver, brass, and lead. For the method of casting statues, see Foundry of Statues.

Darius, the son of Artabanus, who lived not only before the siege of Troy, but even before the expedition of the Argonauts, among many other notable contrivances ascribed to him, is said to have been the inventor of statues. And yet it is certain, there were statuaries before him; only it was he who ﬁrst found how to give them action and motion, and to make them appear as if alive. Before him, they made them with the feet joined together, never intending to express any action. He ﬁrst loosened the feet of his, and gave them the attitudes of people walking and acting. The Phoenicians are said to have been the ﬁrst who erected statues to the gods. The Greeks succeeded in their statues beyond the Romans, both the workmanship and the fancy of the Roman statues being inferior to the Grecian. Indeed we have very few remaining that have escaped the injuries of time.

Statues are usually distinguished into four general kinds. The ﬁrst are those less than the life; of which kind we have several statues of men, of kings, and of gods themselves. The second, those equal to the life; in which manner it was that the ancients, at the public expense, used to make statues of persons eminent for virtue, learning, or the services they had done. The third, those that exceed the life; among which, those which usurp the life once and an half, were for kings and emperors; and those double the life, for heroes. The fourth kind were those that exceeded the life twice, thrice, or even more; and were called colossal.

Every statue resembling the person it is intended to represent, is called statue iconica. See Sculpture.

**Statute, Allegorical, that which, under a human ﬁgure, or other symbol, represents something of another kind, as a part of the earth, a sea, a plant, an element, a temperament, a colour, &c.**

**Statue, Caryatic. See Caryatides.**

**Statue, Colossal. See Colossus.**

**Statue, Cupid, those which are represented in chariots drawn by bigs, or quadrige, that is, by two or four horses: of which kind there were several in the circuses, hippodromes, &c. or in cars, as we see some, with triumphal arches, on antique medals.**

**Statue, Equestrian, that which represents some illustrious person on horseback; as that famous one of Marcus Aurelius at Rome, and that of king Charles I. at Charing-Crofts.**

**Statue, Greek, denotes a ﬁgure that is naked and antiqua,
tique, it being in this manner the Greeks represented their deities, athletes of the Olympic games, and heroes. The reason of this nudity, by which the Greek statues are distinguished, is, that those who exercised wrestling, in which the Greek youth placed their chief glory, always performed naked.

The statues of heroes were particularly called Achillia statues, by reason of the great number of figures of that prince in most of the cities of Greece.

Status, Hydraulix, any figure placed as an ornament of a fountain, or grotto, or that does the office of a jet d'eau, a cock, spout, or the like, by any of its parts, or by any attribute it holds. The like is to be understood of any animal serving for the same use.

Status, Pedestial, a statue standing on foot; as that of king Charles II. in the Royal Exchange; and that of king James II. in the Privy-Gardens.

Status, Persian, See Persian.

Status, Roman, is an appellation given to such as are clothed; and which receive various names from their various dressers.

Those of emperors, with long gowns over their armour, were called statue paludata; those of captains and cavaliers, with coats of arms, thoracata; those of soldiers, with cuirasses, loricata; those of senators and augurs, trabata; those of magistrates, with long robes, togata; those of the people, with a plain tunic, tunica; and lastly, those of women, with long trains, folate.

The Romans had another division of statues, into divine, which were those consecrated to the gods; as Jupiter, Mars, Apollo, &c.; heroes, which were those of the demi-gods; as Hercules, &c.; and Augusti, which were those of the emperors; as those of Caesar and Augustus, under the pontific of the Capitol.

Status, Foundery of. See Foundery.

Status, Pedestal of. See Pedestal.

Status, Plinth of. See Plinth.

Status, Repairing a. See Repair.

Status, the site, or height of man; derived from the Latin statua, of stare, to stand.

The stature, or pitch, of a man, is found admirably well adapted to the circumstances of his existence. See Dwarf and Giant.

It is a common opinion, and has been so ever since Homer's time, that people in the earliest ages of the world much surpassed the moderns in stature; and, it is true, we read of men, both in sacred and profane history, whose pitch appears surprising; but then, it is true, they were, even then, esteemed giants.

The ordinary stature of men, Dr. Derham observes, is, in all probability, the fame now as at the beginning; as may be gathered from the monuments, mummies, &c. still remaining. The oldest monument in the world is that of Cheops, in the first pyramid of Egypt, which, Mr. Greaves observes, scarcely exceeds the measure of our ordinary coffins. The cavity, he says, is only 648 feet long, 2218 feet wide, and 2580 feet deep: from which dimensions, and those of several elongated bodies observed by him in Egypt, that accurate writer concludes, there is no decay in nature; but that the men of this age are of the same stature as those three thousand years ago.

To these, we have after and later influences to add from Hakewell: the tombs at Pisa, which are some hundreds of years old, are yet no longer than ours. The fame may be laid of Athelstan's in Malmbury church; and of Sheba's in Paul's, of the year 695, &c.

The like evidence we have from the ancient armour,

Vol. XXXIV.
Statute-Staple is a sort of statute-merchant, relating to merchants and merchandizes of the staple; which fee.

The staple-Staple is of two kinds; proper and improper.
The proper is a bond of record, acknowledged before the mayor of the staple, in the presence of one or more constables of the staple; by virtue of which the creditor may forthwith have execution of the body, lands, and goods, of the debtor, on non-payment.

This and the statute-merchant are both securities for debts, originally permitted only among traders for the benefit of commerce; by which the lands of the debtor are conveyed to the creditor, till out of the rents and profits of them his debt may be satisfied; and during such time as the creditor holds the lands, he is tenant by statute-merchant, or statute-Staple.

Improper is a bond of record, or recognizance, founded upon the statute 23 Hen.VIII. cap. 6. of the nature of a proper statute-Staple as to the force and execution of it, and acknowledged before one of the chief justices; or, in their absence, before the mayor of the staple, and recorder of London; which extends the benefit of the mercantile transactiion, already mentioned, to all the king's subjects in general.

STATUTO MERCATORIO, a writ for the imprisoning him that has forfeited a statute-merchant bond, until the debt be satisfied; and of these writs there is one against lay persons, and another against persons ecclesiastical.

Statuto Stapula, a writ that lies to take the body to prison, and seize upon the land and goods of one who hath forfeited the bond called statute-Staple.

STATUTUM de Laborariis, an ancient writ for the apprehending such labourers as refuses to work according to the statute.

STAVANGER, in Geography, a sea-port town of Norway, in Christiantown, situated on a bay of the North sea; anciently the fee of a bishop, but removed, after the town was burnt in the year 1688, to Christiantown; 86 miles S. of Bergen. N. lat. 58° 50'. E. long. 5° 44'.

STAVANI, in Ancient Geography, a people of European Sarmatia, according to Ptolemy; who also gives the same name to a people in the northern part of Aria.

STAVELOT, in Geography. See STABLO.

STAVENAU, a town of Brandenburg, in the Mark of Pregnitz; 7 miles N.W. of Perleberg.

STAVENHAGEN, a town of the duchy of Mecklenburg; 24 miles E. of Gyllow. N. lat. 53° 40'. E. long. 11° 24'.

STAVEN, a town of Holland, and the most ancient of Friesland, supposed to have been built one year before the commencement of the Christian era, and to have taken its name from an ancient idol, worshipped by the inhabitants, called "Staan." Great part of the ancient town having been destroyed by the sea, the inhabitants rebuilt it in the place where it now stands, as being least exposed. It was anciently a very rich, powerful, and populous city, with the best harbour in that country. The ancient kings of Friesland built it their ordinary residence, the palace built by Richolde, the first king, about the year 450. Radbode VI. after he had conquered all the country as far as Utrecht, called his conquests the Kingdom of Staveren, which flourished the flourishing state of the town at that time, and was the occasion of its being included in the league of the German Hanse towns. It was surrounded with walls and ditches, about the year 339, by Obidalde VI. duke of Friesland. It is since reduced very much from its ancient grandeur, the harbour being choked up; however, there remains enough of its former splendour to make it a considerable
town; and they still carry on some trade, especially in fishing, and in paissage-boats over the pools and lakes of the neighbourhood. In 1796, the town was taken by the British fleet; 40 miles N. of Amsterdam. N. lat. 52° 56'. E. long. 10° 46'.

STAVERN. See Fredriksvorn.

STAVERS. See Stuvera.

STAVES. Flag. See Flag-Staves.

STAVE, Lewes. See Lewelling-Staves.

STAVES, Tp. See Tip-Staves.

STAVESACRE. Staphiasioria, in Botany; for the characters, see Delphinium.

Staveacre, Delphinium hispoidagnus, grows in Provence, Languedoc, and many other southern parts of Europe.

The seeds, which are the only part of the plant directed for medicinal use, are usually imported here from Italy; they are large, rough, of an irregular triangular figure, and of a blackish colour on the outside, but yellowish within; their shell is disaggregable, and somewhat lefled; to the taste they are very bitter, acrid, and nauseous. Their virtues are extracted partially by water, and completely by rectified spirits.

These seeds seem to have been known to the ancients, by whom they were employed as a mastrictory: for, on being chewed the excite a copious flow of saliva, and on this account were recommended in tooth-aches, and other painful affections of the face and gums. The ancients also prescribed them with a view to their emetic and cathartic effects in doses of twenty or fifteen grains; but the deleterious narcotic qualities of staveacre were discovered to be so powerful as to forbid its internal use. Schultz, only by keeping it some time in his mouth to relieve a tooth-ache, was for a time deprived of his senses, and Hillefeld has related, that a dog, by taking five scruples of these seeds, became convulsed, and soon died. Staveacre is now, therefore, confined to external use in some kinds of cutaneous eruption, but more especially for destroying lice and other insects; and by its efficacy in this way, this plant, in most of the European languages, is distinguished by the name of louse-wort.

Stave, a castle of Germany, in the principality of Nassau, Saarbruck Ufingen.—Alfo, a castle of Germany, in the principality of Anspach, with a citadel; 90 miles S.E. of Anspach.

STAFFEN, a town of the Brugia, on the Mehlbach; 24 miles N.E. of Bâle. N. lat. 48° 54'. E. long. 7° 48'.

STAFFENBURG, a town of Upper Hesse; 5 miles N.E. of Gießen. N. lat. 50° 40'. E. long. 8° 45'.

STAVIGNETTI, a town of Walachia; 42 miles E.E. of Ierapoli.

STAUNTON, a post-town of America, in the state of Virginia, and capital of Augusta county; situated on the E. side of Middle river, a water of Patowmac, N. of Maddison's cove. It contains about 160 houses, mostly constructed of stone, a court-house and gaol; 100 miles S.W. by S. of Winchester. —Alfo, one of the principal branches of Roanoke river, which rises on the western side of the Blue Ridge, where it has the name of Roanoke, but when it has passed through the ridge, it takes the name of Staunton, and preserves to it its confuseness with Dan, there refusing the name of Roanoke. It might be made navigable for 100 miles from its mouth. It receives several streams.

Staunton's Island, a small island near the east coast of China. N. lat. 36° 47'. E. long. 128° 13'.

STAVRER HOVED, a cape of Denmark, on the east coast of the island of Fyen. N. lat. 55° 29'. E. long. 10° 46'.

STAVURI, in Ancient Geography, a people of Asia, in the environs of Hyrcania. Pliny.

STAUROLITE, Granatite of Saussure and Werner, and Staurotide of Huy, in Mineralogy, a stone of the glistening genus according to Kirwan, of a reddish or blackish-brown colour, which seems always crystallized. Its crystals are of an hexahedral prismatiform form, four faces of which are the largest, meeting in pairs, and forming two obtuse angles, measuring 120°. The prism is either entire or truncated on the obtuse angles. It is not uncommon to find two crystals penetrating each other obliquely, or at right angles, so as to form a cross; sometimes even three prisms are thus arranged, forming a triple cross, whence its name of "Croftone."

Its surface is smooth or uneven, and its lustre varies considerably. Internally it is more or less shining, with a lustre between vitreous and resinous. Its fracture, parallel to the axis, is imperfect lamellar, and in the opposite direction it is small-grained uneven, passing to conchoidal. It is brittle, and somewhat harder than quartz. Sp. gr. 3.38. Exposed to the blowpipe, it undergoes no other change besides that of fritting a little on its surface. Its component parts, according to an analysis by Vaucufile, are

- 33. Silex.
- 44. Alumine.
- 3.84. Lime.
- 1. Oxyd of manganese.

This mineral is found in St. Gothard, in Switzerland, in small crystals, imbedded in micaceous schistus, and accompanied with cyanite; in Brittany, near Quimper, in middle-sized crystals, imbedded in a micaceous clay, apparently produced by the decomposition of some primitive rock; also at St. Iago de Conisffelas, in a primitive rock. Aikin.

STAUROPHORI, Σταυρόφοροι, compounded of σταυρός, a cross, and φόρος, I carry, in Church History, certain ecclesiastics, whose business it was to carry the cross in processions.

STAUROPHYLAX, Σταυροφυλακη, derived from σταυρός, a cross, and φυλακη, I keep, a dignified officer in the church of Constantinople, to whose care the keeping of the cross, found by St. Helena, was committed.

STAUROPOL, in Geography, a town of Russia, in the government of Simbirsk, on the Volga; 44 miles S.E. of Simbirsk. N. lat. 53° 44'. E. long. 48° 48'. —Alfo, a town of Russia, in the government of Cazacow, on the Volga; 86 miles W.N.W. of Ekaterinosgrad. N. lat. 44° 56'. E. long. 41° 57'.

STAVROS, or STAuros, anciently Stagira, a town of European Turkey, in Macedonia, the native place of Aristotle; situated in the gulf of Coatefa; 46 miles E.E. of Saloniki.

STAUROTIDE, in Mineralogy, the name given by Huy to grautite. See Staurolite.

STAUSEE, Fort, in Geography, an American fort, just above the falls of the Niagara, and eight miles above Queen's Town.
STAUSTADT, a town of Switzerland, in the canton
of Unterwalden; 6 miles S.E. of Lucerne.

STAXIGO HARBOR, a bay of Scotland, on the east
coast of the county of Caithness; 1 mile N. of Nobs Head.

STAXIS, a word used by the ancient physicians to ex-
press a distillation of the blood in drops from the nose.

A fluxis, in the doctrine of crises, is justly condemned
as indicating a weakness and decay of strength in nature;
whereas, on the contrary, free and copious discharges of
blood from the nose are esteemed good indications, and often
make happy crises.

STAY, in Sea Language, a strong rope employed
to support the masts on the fore-part, by extending from
their upper end at the mast-head towards the fore-part of
the ship, as the hounds are extended to the right and left,
and behind it.

The stays are denominated from the masts, as the lower
stays, topmast stays, top-gallant stays, flag-staff or royal
stays, &c.

Back-stays, breast, shifting, and standing, are stays which
support the topmasts and top-gallant-masts from aft: they
reach from the heads of the topmast and top-gallant-mast
to the channel on each side of the ship, and affix the hounds,
when strained by a press of sail. The shifting back-stays
chain according to the action of the wind upon the sails,
whether aft or upon the quarter. Bob-stays are stays used
to confine the bowspirit down upon the foremast, and counteract
the force of the stays which draw it upwards. Stay-fall
stays are those on which the stay-falls are extended. The
jib-stay is similar to the stay-fall stays, and extends the jib.
The martingale-stay supports the jib-boom, as the bob-stays
support the bowspirit. Preventer-spring-stays are subsidiary
stays to support their respective stays, and supply their
places, in case of any accident. The practice of placing
the spring-stays before the foremost crosstrees, and of
bringing the catheadspins and futtock-hounds to the mast,
is now freely forbidden in the navy, as the placing of the
spring-stay before the foremost crosstrees was with a view
to separate it from the standing stay: it is for the future to
be effected, by placing the collars five or six feet apart on
the bowspirit. Static-stays are ropes used for hoisting or
lowering burdens in or out of ships. Stay-rope have four
frands, with a heart running through the middle, which
keeps the rope true; and when hawser-laid as a rope, pre-
vents it from tretching, and the frands have each their
proper bearing. The stays are made of five yarn, spun
from the beit topt hemp. Twenty threads a-hook make a
rope three inches in circumference, and fo in proportion for
any size. The yarn is warped to the length and size for
the stay wanted. The frands are warped long enough for
one frand to make two, when hauled about and hung upon
the back-hook. By this an eye is left for the upper end of
the stay to go through and form a collar, to go over the
mast-head. For stays of nine inches in circumference, each
frand should be 3/4 inches, and fo in proportion. The
heart must be near the face of the frand, or the rope will
not lie round and true. Particular attention should be paid
to making the stays, as on them the safety of the mast, &c.
greatly depends. Main, fore, and mizen-topmast, and some
top-gallant-mast-stays, are cable-laid.

The stay of the fore-mast, called the fore-stay, reaches
from the mast-head towards the bowspirit-end; the main-
stay extends over the fore-castle to the ship's stern; and the
mizen-stay is stretched down to that part of the main-mast
which lies immediately above the quarter-deck; the fore-
topmast-stay comes also to the end of the bowspirit, a little
beyond the fore-stay; the main-topmast-stay is attached
to the head or hounds of the fore-mast; and the mizen-topmast-
stay comes also to the hounds of the main-mast; the fore-
top-gallant-stay comes to the outer end of the jib-boom;
and the main-top-gallant-stay is extended to the head of
the fore-topmast.

STAY a Ship, To, or bring her on the Stays, is to manage
her tackle and sails, so that she cannot make any way
forwards, which is done in order to her tacking about.

STAY, in the Manage. To stay, or furlain your horse,
is to hold the bridle firm and high. We likewise stay or
furlain a horse with the in-leg, or in-heel, when he makes
his course go before his shoulders upon a volley; as also when
we hinder him to traverse, and ride him equally, keeping
him always subjects, so that his course cannot fly out, and
he cannot lose either his cadence, or his ground, but marks
all his times equal.

STAY-Sail, in a Ship, a fort of triangular sail extended
upon a stay. See SAIL.

STAY-Sail-Stay-Tackle. See TACKLE.

STAY-Tackle Pendants. See PENDANTS.

STAYNER, Sir Richard, in Biography, was the gall-
 surrender and during the protectorate;
and, in conjunction with captain Smith, took a Dutch East
India ship of 8oo tons burden, having on board four chefs
of silver. In 1676 he was appointed to the command of
three frigates, and with this small squadron he fell in with
the Spanish flotilla, confining of eight sail, of which he
captured two, burnt one, sunk another, and drove two
on shore. The treasure captured on this occasion amounted to
six hundred thousand pounds sterling, so that captain
Stayer returned to England not only crowned with glory,
but laden with wealth. In the following year he again
failed with the fleet, under the chief command of Blake, for
the purpose of intercepting the Spanish West India fleet,
which had taken shelter in the bay of Santa Cruz. On re
connoitering the force and position of the enemy, the Eng
lish admiral found it impossible to bring off the enemy's
ships, though he thought they might be destroyed. Stayer
was immediately detached to begin the attack, and being
supported by Blake with the remainder of the fleet, the
Spaniards were, in a very few hours, driven out of their
ships and breast-works. The former were infanty taken
possession of by the English, and, as they could not be
brought off, they were all set on fire, and burnt to the
water's edge. "The whole action," says lord Clarendon,
"was so miraculous, that all men, who knew the place,
 wondered that any sober people, with whatever courage
endowed, would ever have undertaken it; and they could
hardly persuade themselves to believe what they had done!
while the Spaniards comforted themselves with the belief
that they were devils, and not men, who had destroyed
them in such a manner." Cromwell thought it highly of the
ducal of Stayer, that he immediately con-
ferred on him the honour of knighthood. On the restora-
tion, sir R. Stayer had a command under Montague,
and afterwards the earl of Sandwich, was again knighted,
and was constituted rear-admiral of the fleet. He first hoisted
his flag in the Swiftsure, and afterwards in the Mary.
After this, the nation being at peace, no opportunity was
offered to this brave man of adding to those services which
he had already rendered his country; and it is thought he
died very soon after. Campbell's Lives of the Admirals,
vol. iv.

ST CLAIR, in Geography. See CLAIR.—Also a
township in Butler county, in the state of Ohio, containing

1180
STEADMAN's Creek, a river of America, in New
York, which runs into the Niagara, above Fort Schlosser.

STEADY, a word of command at sea, given by the
pilot to the man at the helm, in a fair wind, to keep the
ship steady in her course, without deviating to the right or
left, or making angles (or gyres, as they call them), in and
out. The helmsman accordingly answers steady; thus de-
noting his attention and obedience to the pilot's orders.

STEAL, in Agriculture. See STALE.

STEALING on Horses. See FORCIBLE ABDUCTION.

STEALING, in Law. See LARCENY.

STEAM, in a general sense, is a term used to signify
the visible clouds and air arising from the condensation
of aqueous vapour.

In those arts and manufactures where the vapour of water
is employed, such as steam-engines, the term steam is used
for water in its elastic form, at or above the temperature
of 212°, and when it is invisible. It is in this form that
we can properly call it steam; as we shall shew, that in the
visible misty form in which we see it in the atmosphere, both
in the form of clouds, and as it passes from a warm medium
into a colder one, it is not steam but water in minute glo-
bules.

Some have confused the word steam to the vapour of wa-
ter not less than 212°, as if water did not assume the elastic
form at a lower temperature; conceiving it to exert the full
force of steam the moment it arrives at that point, and to
be wholly converted into water when reduced below the
same. Nothing, however, can be more absurd than this
notion: steam can exist at the lowest known temperature.
At 50° below the cypther of Fahrenheit, if the barometer
could shew it, the presence of ice would afford an elastic
fluid of some force. We want no other proof of this fact
than the experiments of different philosophers to ascertain
the force of aqueous vapour, answering to different tem-
peratures; and before we proceed further on our subject,
it may not be amiss to give the table of these facts, formed
by Mr. John Dalton of Manchester. In order to make
these experiments, Mr. Dalton took a barometer of the
common size. The mercury was first boiled, to free it
from air. He then put a little water into the tube, and
poured it out again, leaving its sides wet; and next intro-
duced the mercury, inverting the tube so as to exclude the
air. The water, being the lightest fluid, rose above the
surface of the mercury about one-eighth of an inch. He
then surrounded the tube, from the top downwards, with
another tube, 14 inches long and 2 inches diameter; form-
ing a cavity between the tubes, capable of holding water of
different temperatures. The temperature of this water was
constantly marked by a thermometer placed in it; and the
elasticity of the vapour, in the upper part of the barometer,
was constantly marked by the height of the mercury. The
outer tube being of glass, the whole could be seen. This
apparatus was used for all the temperatures below 155°.
For the higher temperatures, as high as 212°, he used an
outer tube of tin, with a siphon barometer.

These results he found to agree with similar experiments
made with the air-pump. The air-pump was provided with
a mercurial gauge of considerable extent. Some water was
first made to boil in a Florence flask, in which a thermometer
was placed. In this state it was put under the receiver,
and then the air being withdrawn, the steam alone affected
the barometer; the thermometer, at the same time, marking
the temperature.

From these facts Mr. Dalton constructed his table. The
altitudes of the mercury, answering to the degrees of tem-
perature, he found not to have a constant ratio; nor did
they vary by any regular progression. When the degrees
were in arithmetical progression, the columns of mercury
answering thereto were not in the same, but something ap-
proaching to a geometrical series. The increase, although
not strictly geometrical, of the ratios themselves diminished
regularly, which enabled him to calculate with sufficient
exactness those degrees which he could not ascertain by
experiment. We seldom find any of nature's laws attended
with any thing so indefinite; and Mr. Dalton very pro-
perly observes, that the defect is not in nature, but in the
imperfect scale of our thermometers, which, M. de Luc
and others have shewn, do not mark equal increments of
heat.


STEAM.

In answer to some references which may be required, we have thought proper to add a third column to this table, shewing the weight of aqueous vapour contained in a cubic foot of space, when a sufficient quantity of water is present at the given temperature. This column has been formed on the fact, that when the force of vapour is 30 inches, the aqueous vapour in a cubic foot of space is equal to 253 grains. And since the density must be as the pressure; therefore, as 30 inches is to 253 grains, so is the force of vapour of any other degree to the number of grains in the cubic foot at the same.

This table, from 30° to 212°, was the result of careful experiment. Those below and above were determined by calculation, and will doubtless be much more correct than by experiment, from the great difficulty and uncertainty which the high and low temperatures would occasion. For a more detailed account of Mr. Dalton’s experiments, see the Manchester Trans. vols. vi. and vii.

These will be found a valuable reference in all practical applications of steam, and will not be of less importance in ascertaining the processes of evaporation, as well as in forming the arts of life, and the natural evaporation in the air. With a view to assist our conception of the nature of steam, or of the elastic vapour of water, we shall consider a number of facts, which may be very proper to commit to memory.

1. A cubic inch of water forms a cubic foot of steam, when its temperature is equal to 30 inches of mercury.

2. One pound of Newcastle coal converts seven pounds of boiling water into steam.

3. The time required to convert a given quantity of boiling water into steam, is six times that required to raise it from the freezing to the boiling point; or from 32° to 212°, supposing the supply of heat to be uniform.

4. When a quantity of water is exposed to a given temperature, the quantity of steam formed in a given time will be as the surface, all other things being equal. The quantity will also be jointly as the force of vapour anfwering to each degree of heat, and the surface.

The depth of water evaporated, in a given time, will be as the force of vapour, whatever the surface, if the mass be uniformly of the same temperature.

When the force of vapour is 30 inches, and the temperature at 212°, this degree being just preferred only, the depth evaporated is 1.5 inch in one hour. This will be near the truth for this temperature. For lower temperatures, the rules given with the table will point it out.

5. When a quantity of water is raised to the boiling point, or 212°, it requires as much heat to give it the elastic form as would raise the same weight of water 900° higher. If its volume were not changed by the heat, that is, if it could be prevented from expanding, its temperature would become 1112°, with the same quantity of caloric. Thus, agreeably to fact the 30°, the heat required to convert water of 212° into steam, is six times that required to raise the temperature from 32° to 212°.

6. The same weight of water, in the form of steam, contains the same quantity of heat, whatever may be its temperature or density; that is, the temperature at which the steam is formed, added to the degrees required to give it the elastic form, is always a constant quantity. The meaning of this is, that if a given weight of aqueous vapour, at 100° for instance, were compressed till its elasticity became equal to that at 212°, no heat being allowed to escape, its temperature would become 212° by the condensation; and it would, of course, contain the same heat as steam formed at the same temperature, viz. 212° + 900°, as mentioned in the last fact.

In viewing the second column of the table, and comparing it with the temperature in the first column, we shall be far from concluding that all the steam in the cylinder of a steam-engine is condensed by the bell mouth employed. Owing to the circumstance of the rapid decrease of the force of vapour from the boiling point, some have been led to imagine that there is no medium between steam at 212° and liquid water. By referring to the table, we shall see that, by a decrease of temperature from 212° to 180°, the column of 30 inches is reduced to 15. This column is again bisected or reduced to 7.5, by the temperature falling to 150°. At 125°, the steam exerts a force equal to 3.75 inches of mercury; and this will be reduced to 1.875, at the temperature of 100°.

We here see the importance of Mr. Watt’s discovery of condensing his steam in a separate vessel. The spring of the residual vapour in his cylinder, after condensation, is only equal to the force of vapour answering to the temperature of his condenser, while the cylinder itself is kept at 212° nearly.

In the old method of condensing in the cylinder, so much cold water would be added as would reduce the temperature as low as Mr. Watt’s condenser, in order to produce as perfect a vacuum; and on filling the cylinder again the next time, it would require to be raised to its original heat, at the expense of fresh steam. The effect of cold water in condensing steam, whether in the cylinder or a separate vessel, may be easily known by calculation, and the aid of the preceding table.

Let $C =$ the capacity of the vessel containing steam in cubic feet.

$S =$ the weight of a cubic foot of steam.

$q =$ the weight of condensing water.

$T =$ its temperature.

$b =$ the degrees of heat to convert water into steam.

$d =$ the temperature of the steam.

$t =$ the resulting temperature, supposing $b$ and $d$ to be sensible heat before the experiment, and $t$ the same afterwards.

$n =$ capacity of steam for heat, water being $t$.

Then, according to a theorem for finding the resulting temperature by mixing bodies of different temperatures together, $t = \frac{qT + (b + d)Cs}{q + Cs}$. In this, will come out as if the steam in the vessel, after mixture, were condensed into water; when, in fact, the heat is divided between the remaining steam and the water, one part giving the whole a common temperature, and the other in a latent form giving elasticity to the vapour. But, according to fact the 6th, as before given, this steam contains as much heat above its own temperature as would raise it to 212°; hence the real temperature added to the latent heat will be equal to $t$.

The conclusion from these facts will be, that $\frac{b + d}{t} = \text{f}$, and $\text{f} = \frac{p}{b + d}$. If we now
STEAM.

Now refer to the table with this force of vapour, we shall find the temperature after condensation. To illustrate this theorem by an example, let

\[ C = 1 \text{ cubic foot.} \]
\[ S = 253 \text{ grains, the weight of a cubic foot of steam.} \]
\[ q = 253 \text{ grains of water.} \]
\[ T = 60. \]
\[ b = 900. \]
\[ d = 212. \]
\[ s = .9. \]

\[ \frac{q + (b + d) Sn}{q + Cs} = \frac{253 \times 60 + (900 + 212) \times 253 \times .9}{253 + 253 \times .9} = 558. \]

Then \( b + d \) and \( f \) of mercury. Now, the temperature answering to this force of vapour, in the table, is equal to 177°.5. The quantity of steam of this density will be \( \frac{30}{558} \), or \( \frac{1118}{558} \), as found, and \( s = .9 \), to be equal to fifteen inches of mercury. Hence, if the capacity of the steam-vessel be known, and the degree of condensation at the same time be given, the supply of cold water for that purpose may be ascertained. This will be \( q = \frac{b + d - t}{s} C S n. \)

We have before hinted at the vulgar idea of there being no medium between steam at 212° and liquid water. A doctrine strongly favourable to such an opinion is at present held by several philosophers of eminence. The elastic form of water, at all temperatures below 212°, is supposed to be a solution of water in air. Does any thing like this appear to be the case in the detail of Mr. Dalton’s experiments, to determine the force of vapour of steam at different temperatures? We would ask, where was the air to diffuse the water above the column of mercury, in which water and mercury alone existed? It is admitted on all hands, that steam at 212° can exist independent of air, and where have we become acquainted with any rule, that aqueous vapour cannot exist in a separate state at other temperatures? This is certainly the case with respect to water; and it is highly probable, that a portion of all the solid and liquid matter on the globe exists in the elastic form, in proportion to the temperature. What is the smell we perceive from melted metals, and at a much lower temperature with some of the metals? This is very conspicuously observed in heating copper-plates and fleet-lead. The odour of cast-iron is particularly flaming.

There can be no doubt that elastic mercury exists in the space above the mercury in a barometer, since the condensed mercury is seen frequently to coat the interior surface.

These appearances would be oftener observed, if it were not for the difficulty with which evaporation takes place, from the body affording the vapour being surrounded with vapour of its own and others. The presence of any elastic fluid mechanically refills further evaporation, to a degree more than is conceived. If water be exposed to a vacuum, a quantity of vapour depending upon the temperature would in a little time occupy the space; the first portion would project itself with great rapidity, and the last very slowly. The temperature being raised, would cause successive portions to rise, the limit being what we have shewn in the table. If at any temperature the vapour, already suspended over the water, be removed by a current or by an air-pump, the processes would be greatly facilitated, as we observe in the drying of the ground in a brisk wind. This shews that the vapour of water refills evaporation more than the air itself; perhaps in the same medium, its retarding power increases as the density. The advocates for the solution of water in air have said, that the capacity of air for moisture is inversely as the density, whether this difference of density arises from the nature of the gas, or from rarefaction. It ought very properly to be asked, at what degree of rarefaction is the dissolved water a maximum? The most probable anwer would be, at the limit of rarefaction. This is contrary to all laws of solution. If air can chemically combine with water, every particle of air may combine with a particle of water; and the quantity of water in a given space would be the greatest, when the air was the densest. If we had no direct proof that a given space will contain the same quantity of water, whether air be present or not, the hypothesis of the chemical solution of water in air could not be defended.

We have seen that the quantity of water in a given space is as the force of vapour in inches of mercury, because the density must be as the pressure. Mr. Dalton has ascertained by experiment, that the rate of evaporation, at a given temperature, is as the force of vapour at the same.


This fact leads to the conclusion, that since the density is also as the force of vapour, the velocity of diffusion through the air is the same at all temperatures. Since, however, the atmosphere always contains some moisture, the next evaporating power will be as the difference between that force of vapour answering to the temperature at which dew would begin to fall, and the temperature to which the evaporating substance is exposed. That point in the atmosphere where dew falls, is called by Mr. Dalton the dew-point. The manner of finding this is as follows: Take a tall cylindrical bottle, about one foot high and three inches in diameter; or, if this is not at hand, a common decanter. Fill it with water so much colder than the air, that the bottle may appear misty, when it is put into it. If no appearance of this kind is observed, the water is not cold enough; and ice, or some freezing mixture, must be added to it. The bottle, when filled, must contain a thermometer. When the dew appears upon it, wipe it off with a clean dry cloth; and continue to do so till no more dew appears. Then observe at what degree the thermometer stands in the bottle, which will never be greater than the temperature of the air, which must also be noted. Then find in the table the force of vapour at the temperature of the dew-point, and also the force of vapour answering to the temperature of the atmosphere, or that of the mass which is the source of the vapour. The difference between these two columns of mercury will be expressive of the rate of evaporation.

In order to obtain absolute data for these proceedes, we shall make use of Mr. Dalton’s facts, which were derived from careful and judicious experiments. He exposed water to different temperatures, to observe the weight evaporated in a given time. These vessels were of a cylindrical form, one being 34 inches in diameter, and the other 4 inches. The latter vessel, when the water in it was just made to boil, loft from 35 to 45 grains per minute; this difference being occasioned by a greater or lesser current of air passing over it. The quantities evaporated at different temperatures were found to agree exactly with the force of vapour. 

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From a vessel of six inches in diameter, he found that at 212° the mean quantity evaporated in one minute was 154 grains. Then since the mean of the small vessel was about 40, if the quantity be as the surface, we ought to have

\[
\frac{154}{40} = \frac{5}{6},
\]

which is very near; for if the small vessel had been 3.05, then the squares would have been in the ratio of 154 to 40.

Mr. Dalton has constructed a table on these data, which, from its great utility in all inquiries relating to the moisture in the atmosphere, cannot fail to be acceptable.

**Table**, showing the Force of Vapour, and the full evaporating Force for every Degree of Temperature from 20° to 85°, expressed in Grains of Water raised per Minute, supposing no Moisture in the Atmosphere at the Time.

<table>
<thead>
<tr>
<th>Temp.</th>
<th>Force of Vapour</th>
<th>Evaporating Force in Grains per Minute</th>
<th>Temp.</th>
<th>Force of Vapour</th>
<th>Evaporating Force in Grains per Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>212°</td>
<td>30</td>
<td>120</td>
<td>154</td>
<td>189</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.129</td>
<td>52</td>
<td>57</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>21</td>
<td>0.134</td>
<td>54</td>
<td>69</td>
<td>86</td>
<td>86</td>
</tr>
<tr>
<td>22</td>
<td>0.139</td>
<td>55</td>
<td>71</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>23</td>
<td>0.144</td>
<td>58</td>
<td>73</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>24</td>
<td>0.150</td>
<td>60</td>
<td>77</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>25</td>
<td>0.156</td>
<td>62</td>
<td>79</td>
<td>97</td>
<td>97</td>
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In order to apply this table to practice, in finding the rate of evaporation at any time, suppose the dew-point found, as above directed, to be 25°, and the temperature of the air at the same time 70°. We find in this table, that the mean rate of evaporation at 45° is 1.62 grains in a minute, the rate at 70° being 3.72. Then 3.7 - 1.62 = 2.08 grains, the quantity evaporated in a minute, under such circumstances. If the example were to ascertain the rate of any artificial evaporation, the temperature of the mass exposed must be taken, instead of the temperature of the air. It must also be observed, that if a brisk wind prevails, the grains evaporated must be taken from the column marked "greater extreme." If there be no wind, look at the "lesser extreme" column; and in a moderate breeze, take the "mean" column. By this means we are enabled to ascertain, at any time, not only the rate of evaporation, but the quantity of water contained in a cubic foot of space.

From the decrease of temperature in the upper regions of the atmosphere, and the greater decrease of the force of vapour at those temperatures, the greatest parts of the water which rises from the earth will be precipitated at a very small height.

If the temperature were taken by a thermometer, the degrees of which should be equal increments of heat, aqueous vapour at any temperature would become of half this density,
STEAM.

flying, by a decrease of temperature equal to 25°. And since, at the intervals of every six miles above the surface of the earth, the pressure, and of course the force of vapour, is halved; the quantity of water in a cubic foot of space must diminish very fast with the height. At the temperature of 50°, when the atmosphere contains as much moisture as the temperature will admit, it contains only 3.5 grains in a cubic foot; and if the temperature upward were to vary no more than 25° for every six miles, at 20 miles high, there would be little more than one grain of water in a cubic foot of space. But the temperature is known to vary much more rapidly; and hence we should have much less water in the same space, on account of the condensation resulting from this greater decrease. Still, however, some portion of water must exist in the very limits of our atmosphere, in a state of steam or vapour of some density; and this vapour is still within the limits of fact the 4th, before given, 8vs. If such vapour were compressed till its density was equal to 253 grains in the cubic foot, its temperature would be 214°, whatever might be its temperature previous to its compression. The same thing, as Mr. Dalton has very ingeniously supposed, would be the case with the air itself; that is, if the rarefied part of our atmosphere were condensed to the density of that at the surface, its temperature would also become the same. This change of temperature in elastic fluids, by rarefaction or condensation, is evidently owing to a change in their specific heat. We have lately heard of a fact, which has excited the curiosity of some philosophers, and surprised others, which is as follows. When steam, of very considerable density from pre-
fusion, is made to issue from the mouth of a pipe, a person may place his finger close to the aperture, without feeling any unpleasant effect from the heat. The sensible heat of this steam, which would otherwise escape, is absorbed by the sudden change of specific heat, by the expansion of the steam. This fact is very analogous to an experiment which has been long known. When the bulb of a thermometer is placed within the nozzle of a pair of bellows, and a blast sent through them, the mercury rises above the common temperature; but if the bulb be placed at a little distance from the nozzle, the mercury falls below the common temperature. In the first instance, the air was compressed, and the heat given out; in the second, heat was absorbed, and consequently the temperature lowered. The cold produced by the exhaustion of the receiver of the air-pump is to be explained in the same way.

The change of temperature of the atmosphere is doubt-
less more regular at considerable elevations, than near the surface; hence the air in which we live is frequently in a strong evaporating state, while condensation is taking place in the superior regions. This gives rise to numerous clouds, which are nothing more than water in small globules, having lost their elastic form by condensation. The changes of temperature, which take place from the various currents arising from the action of the sun upon the earth, materially and constantly change these appearances; sometimes causing the disappearance of opaque clouds, and at other times darkening the air by sudden condensation. We can but, therefore, regard the water in the air as existing in two states, namely, in the liquid and in the elastic state, between which there can be no medium: for evaporation or condensation must be the result of the slightest change of temperature; we may conclude, that one of these processes will commence with the change, and will progressively go on till as much water is either precipitated or taken up as the temperature will admit. Evaporation, as we have before observed, can never be instantaneous; even if the air did not mechanically refill it, the presence of the vapour already formed would have that effect. Although there appears to be no medium between water and steam, the actual precipitation of the water is progressive, and is more or less rapid at different times. The clouds which appear to be suspended in the atmosphere are constituted by an assemblage of small globules of real water, which in vacuo would be precipitated with a rapidity agreeing with the laws of falling bodies; but in consequence of the resistance of air, their descent is retarded, being dependent upon the ratio between their surface and solidity.

There are good reasons for supposing that these globules are prevented from uniting by the presence of electricity, as we know that they must repel one another when they are similarly electrified. On the contrary, when particles are intermixed having contrary states of electricity, the condensation will be much facilitated, as we perceive in rain immediately succeeding thunder. In all those situations where steam undergoes condensation, we do not see water immediately precipitated. The milky appearance is caused by small globules of real water falling towards the earth with a small but progressive velocity. If the change of temperature causing the condensation be very slow, the globules are extremely small in the first instance, and are with more difficulty united. This is doubtless the case with all bodies which are perfect liquids. Globules of mercury are united with greater difficulty the smaller they are. The state in which mercury exists in liquid form, is in these minute globules produced by the mechanical action in mixing it. If boiling water is poured upon mercurial ointment, the fat is separated and floats upon the water; this may be poured off, and the mercury will be left in minute globules, which are united with great difficulty. It occupies a much greater space than when united, having the appearance of froth. Such is the state of water forming the white fleecy clouds which we frequently observe at a great height; the dense dark-coloured clouds being composed of larger globules, which seldom remain long before they are more completely formed into drops of rain.

The clouds, therefore, are not to be considered as absolutely suspended, but as water in globules of different magnitudes, falling with a velocity in the inverse ratio of their magnitudes. There is nothing hypothetical in this idea, since it is within the limits of calculation to ascertain the magnitude even of particles of lead falling through any assignable space in a given time. We cannot demonstrate the principle better than by solving the following problem.

What must be the diameter of a globule of water, to be capable of falling one inch in a second, after it has acquired an uniform velocity.

Let \( e \) = the specific gravity of the air through which the steam falls, water being 1.

\( \rho = 3.1416, \&c. \)

\( g \) = the space a body falls in one second by gravity.

\( v \) = the velocity.

\( s \) = the diameter of the globule which is required.

Then, since the particle will cease to be accelerated when the resistance is equal to its weight, the velocity at that point will be \( v \), which it will uniformly retain, all other things remaining equal. The space fallen through to give \( v \), will be \( \frac{v^2}{2g} \); this, multiplied by \( \rho s^2 \), will give the \( \frac{4}{3} \pi s^3 \) content.
STEAM.

content of the cylinder of air; and \( \frac{\rho \cdot v \cdot a}{8g} \) = the weight of the cylinder. This would be equal to the resistence, if the surface presented to the refisting medium had been a plane perpendicular to the direction. The resistence of such a surface to that of the spherical one, is as 1 to 2.

Hence the resistence will be \( \frac{\rho \cdot v \cdot a}{16g} \).

The weight of a globule of water of the diameter \( a \), will be \( \frac{1}{6} \cdot \rho \cdot a^3 = \frac{\rho \cdot v \cdot a^3}{16g} \). Then, since \( r = 1 \) inch, \( g = 194 \) inches, \( \epsilon = .0018 \), \( \rho = 3.1416 \),

\[ \frac{a}{6} \cdot \frac{3}{8} \cdot \frac{1}{194} \cdot \frac{1}{0.0018} \cdot \frac{3.1416}{194} = .0000461 \text{ of a grain, and in weight only .0000461 of a grain.} \]

When we consider how inconceivably small the atoms of water must be, it will be easy to conceive globules of water much smaller than the above calculation gives.

We are quite aware of the difficulties attendant on the belt theory of clouds and rain. If the view we have given is supported by facts and observation, which at present appears to be the case, we may expect it to stand on firmer grounds than has hitherto been the fate of numerous hypotheses, as it is free from any thing gratuitous or hypothetical.

Steam is at present applied to many economical purposes, as well as in various manufactures, independent of its important office in the steam-engine.

In dyeing, bleaching, and many other similar departments, it is used to communicate heat to water, instead of having separate fire-places and boilers. The vessels to contain hot water, which were formerly separate pans or boilers, are now supplied from one principal close boiler, similar to those used for steam-engines, by separate steam-pipes. When the economy of the steam is considered an object, the pipes for conveying the steam should be cased with wood, or otherwise covered with some bad conductor of heat, which will not be affected by the heat of 212 degrees.

The boiler, which supplies the steam, should be placed lower than any reservoir of water which it has to heat, as in that cafe the water, which may sometimes condense in the pipes, may run back into the boiler. This affords a little economy, by favoring the degrees of heat between the hot water and the cold, with which the boiler is supplied. Another advantage is in the pipes not being liable to be choked by the coagulating water not being allowed to get out of the way of the steam. For heating water in brewhouses, walk-houses, dyeing-vats, &c. the steam-pipe comes directly into the water, the steam passing into the flame making a loud noise, like the rapid cracking of a whip. For heating large baths and buildings, the steam is condensed in the pipes which pass round the bath or around the rooms, and the water should in this case run back into the boiler. The pipes, or other metallic vessels in which the steam is condensed for the purpose of warming rooms, should be coated with paint, the blacker the better. This is found to give heat much more rapidly than the metallic surface, and in a still greater excess above a polished metallic surface.

When steam is employed for the purpose of heating water, the supply for a given quantity of water will be easily calculated by the data already given.

Let \( L \) = the heat required to convert water into steam at 500 degrees.

\( W \) = the weight of the water to be heated by steam.

\( T \) = its temperature.

\( t \) = the temperature to which it is required to be heated.

\( S \) = the weight of steam required.

\( b \) = the temperature of the steam.

Then 
\[ \frac{L}{W} \cdot S + \frac{T}{S + W} \text{, and } S = \frac{L + b - t}{b - t}. \]

A simple rule for finding the quantity of steam required to raise a given weight to any given temperature arises out of this formula. Multiply the water to be warmed by the difference of temperature between the cold water and that to which it is to be raised for a dividend. Then to the temperature of the steam add 500, and from the sum take the required temperature of the water. This half remainder being made a divisor to the above dividend, the quotient will be the quantity of steam, in the same terms as the water.

What quantity of steam at 212 degrees will raise 100 gallons of water at 60 degrees to 212 degrees? 
\[ (212 - 60) \cdot 100 = 152 = \frac{900}{9} \]

17 gallons of water, formed into steam. This quantity of steam from a boiler containing about 27 cubic feet, with a fire applied to the boil advantage, will be fulfilled in 2 hours and 16 minutes, supposing no heat to be lost by the heated mass being exposed. The coal consumed for this purpose will be about 23 or 24 lbs., depending on its quality.

The theorem above given will apply to any temperature above 212 degrees, when the steam is under greater pressure than 20 inches of mercury. It will also appear from the table of the force of vapour, that any degree of heat short of endangering the vessels, may be given by steam under different degrees of pressure. Such means are at present employed for evaporating water from sugar, salt, and other fluids requiring a greater degree than 212 degrees. It will be equally obvious, that an uniform heat may be kept up below 212 degrees, by adjusting the steam-cock through which the medium to be heated is supplied. In giving heats above 212 degrees, the vessels should be completely steam-tight, and very strong. The boiler should have a safety-valve, which should always be kept clean and free to act.

Steam is employed to great advantage for culinary purposes. It is made to communicate with vessels in the form of boilers, as a substitute for having fires under them, which is a great advantage, both in the economy of fuel, and in avoiding at the same time the nuisance of ashes and smoke.

The most convenient application of steam for culinary purposes is, when it directly acts upon the substance to be heated. This has been generally effected by placing the substance, whether meat or vegetables, in a vessel without water, and allowing the steam to enter and condense upon it. The most convenient apparatus of this kind we have yet heard of, consists of a cast-iron plate about 30 inches or three feet square, standing horizontally in a receve in the wall, like a table. Round the edge of this plate is a groove, about half an inch wide and two inches deep. Into this groove fits an inverted tin-veil, like a dish-cover. This is capable of being elevated and depressed by a pulley and chain, having a counterpoise,
STEAM.

terpoles, in order to expose the table at any time. The steam comes under the table and enters in the centre. The dishes to receive the heat are placed on any part within the groove, the steam being common to all. The water resulting from the condensation runs into the groove, and at a point short of the top runs off. The water which remains forms a complete water-lute, to prevent the escape of steam. The table being placed in a recfex, like a common stone hearth, a small flue is placed over it to take away any steam that may escape when the cover is lifted up.

The great quantity of hot water required in a scullery should be one flue connected up to the bottom of the cylinder, by which the latter is kept constantly full. The hot-water cylinder is closed firmly at the top, and therefore, when the air is allowed to escape, the water rises to the top. If now a pipe be connected with the top, coming down to where it is to be drawn off, and any portion be drawn out here, as much will come in at the bottom of the cylinder from the re protector above. So far we have described this cylinder without its steam-vessel. Within this cylinder, and about the middle, is a distinct vessel, nearly of the width of the cylinder; but having a free space round the inner vessel about an inch wide. The depth of the inner vessel must be about one-sixth that of the outer one. This inner vessel must have no connection with the outer one, and must be so water-tight, that although it is surrounded with the water of the outer one, none should get in. The inner vessel is on one flue connected the pipe with a steam-boiler, having another pipe to allow the condensed water to run off, which may be preferred as distilled water, and is valuable for many purposes. The heat arising from the condensation is communicated to the water in the outer vessel, the hottest being at the top, where the mouth of the exit-pipe is placed. When, therefore, a portion of hot water is drawn from the cock, the pipe of which comes from the top of the vessel immediately under the cover, an equal quantity comes in at the bottom from the re protector. This is the apparatus is the invention of an ingenious person, a citizen of Derby, and is at present in use in his kitchen.

When steam is properly applied to the warming of baths, the economy is so great, that if it were known, these exquisite luxuries would soon become more fashionable. The steam is condensed in pipes about two or three inches in diameter, which are placed round the bottom of the bath. These pipes are concealed in a recex, which is afterwards covered by thin stone plinths, perforated with holes to allow the water to circulate.

We shall point out the economy of these baths, by giving some facts of a bath in common use. Its size is about 10 feet square, and its depth such as to contain about 520 cubic feet. The steam at 212°, to first raise it from 32° to 96°, will be found by the above theorem to be as much as will condense it into 33 cubic feet of water. This will be produced by 30 lbs. of coal, including that required to raise the 33 cubic feet of water from 32° to 212°, which is always about 3th of what will afterwards make it into steam.

Supposing the bath to have double doors, and a small skylight instead of common windows, it will be found, when the outer air is 45°, that the bath will not cool more than 4° in 24 hours. To reheat this every day, will require only 3th of what was required to raise it from 32°. This will be about 23.5 lbs. Supposing the whole water of the water to be changed by a regular inlet and outlet every 14 days, then the weekly supply of coal for such a bath will be about 350 lbs.

It is suggested by Dr. Darwin, that the art of boiling vegetables of all kinds in steam instead of water, might probably be managed to advantage, as a greater degree of heat might be thus given them, by contriving to increase the heat of the steam after it has left the water; and thus the vegetable mucilage in roots and seeds, as in potatoes and flour-puddings, as well as in their leaves, stems, and flower-cups, might be removed, probably more nutritive, and perhaps more palatable; but that many of the leaves of vegetables, as the fumus of cabbage-fsprouts, lose their green colour by being boiled in steam, and look like blanched vegetables. This etiolation of some vegetables by steam is probably owing to its dissolving their colouring matter, which may then become decomposed, and may render them less agreeable to those who choose by the eye rather than the palate; which green colour is, however, heightened by boiling them in some hard waters which contain an un decided lime or soda, or by a slight admixture of common salt with soft water; an effect which is owing to the evaporation of a part of the marine acid, and to the remaining alkali which was the basis of it, when applied to blueish vegetables converting them into green, as in the common experiment of adding salt of tartar to syrup of violets, or according to the custom of some cooks who add a little potash, or fixed vegetable alkali, to the water in which young peas are boiled, to make them green, and afterwards a very little sugar to sweeten them. And the same effect of making vegetables green, when boiled in another kind of hard water, is probably produced by the lime which abounds in them, and which, like the vegetable alkali, when the aerial acid which was united with it evaporates, is said to convert bluish vegetable colours into green ones.

Steam has likewise lately been applied in gardening to the purpose of forcing plants of different kinds in the winter season, in order to have their produce at an early period, as to the cucumber, and some other vegetables of a somewhat similar nature; but the exact manner of its application in this instance, so far as we know, has not yet been communicated to the public; it is, however, by some mode of fluxes, pipes, and other contrivances for conveying and containing it, so as to allow its heat to be uninterrupted, equally, and regularly afforded to the roots of the plants which it is designed to push forward into the fruiting state. It is said to have been used in some instances in different parts of Lancashire with great success. But how far the expense and advantage of such a method may admit of and encourage its being introduced into general practice, have not, probably, yet been well or fully ascertained. If it should be found capable of perfectly succeeding in this use, on more full and correct experience, it will, however, constitute not only a neat and clean, but an elegant mode of forcing plants into fruit at early seasons.

It has been found that subterranean steam often affect the surface of the earth in a particular manner, and promote or retard vegetation more than almost any thing else.

Steam-Engine, or Fire-Engine, a machine very generally employed in this country as a first mover of other engines and machines, its mechanical force or moving power being obtained from the expansion or contraction of the steam of boiling water. Until of late years this machine was called the fire-engine, because it is in reality excited by the fire which carries the water to boil.
STEAM-ENGINE.

The steam-engine is an invention highly creditable to human genius and industry, and is amongst the most valuable applications of philosophical principles to the arts of life. The invention of a ship, with all her accoutrements, and the degree of knowledge requisite to conduct her through a distant voyage, are more striking instances of the power of the mind of man, and of his enterprising disposition; whether we consider the number of sciences which must be applied to practice in the construction and management of a vessel; or the advantages which mankind have derived from such an invention, and the improvements which it has occasioned in the state of civilization, by uniting, in a great degree, all the inhabitants of the globe in one society, who mutually supply each other's wants, and who all contribute their share to the general flock of knowledge.

The steam-engine follows next to the ship in the scale of inventions; but in an English Cyclopaedia it will take the lead, from the circumstance of its being wholly invented, and brought into general use, by our own countrymen, within the space of a single century; and also as having been the principal means of effecting those great improvements which have taken place in all our national manufactories within the last thirty years; and the increase of our commerce which has ensued.

The art of navigation is the result of the combined ingenuity and experience of all nations, from the earliest period of history to the present time; and the successive and almost imperceptible improvements by which it arrived at its present state of perfection, have many of them been the productions of accident, and for which we do not exactly know to whom we are indebted. But the steam-engine is the invention of a few individuals, all of them Englishmen; and brought into general use within a century. In the first beginning it was the result of reflection, and the production of a very ingenious mind; and every alteration in its construction and principle was also the result of philosophical enquiry.

General Principle of the Steam-Engine.—The force of the steam-engine is derived from the property of water to expand itself, in an amazing degree, when heated above the temperature at which it becomes changed into the state of vapour, which being an exceedingly elastic fluid, can be retained within the close vessel or boiler to which the heat is applied, even when it has an expansive force sufficient to make it fill, if left at liberty, 20 or 30 times the space in which it is confined. In this state the steam will exert a proportionate force or preffure to burst open the sides of the vessel in which it is retained; which force may be applied either to expel or raise up water from any vessel into which the confined steam is admitted, or to give motion to a moveable piston, which is so accurately fitted to the interior capacity of such vessel, as not to permit the escape of the steam between them.

Another source of the power of the steam-engine is the facility with which steam of a great expansive force can be cooled by the application of cold water, and condensed into the small quantity of water from which it was originally produced. A partial vacuum can thus be made, in a very large vessel, in an instant, and even in the same vessel, which was a moment before, filled with confined steam, exceeding $212^\circ$ Fahrenheit's thermometer. The preffure of the atmosphere which tends to fill up this vacuum, can be made to produce the ascent of water into the vessel to any height less than twenty-four or twenty-five feet. Or the preffure of the atmosphere may be made to give motion to a piston, by admitting the atmospheric air to press upon one side of the piston, whilst there is a vacant space formed by the condensation of the steam which filled the cylinder on the other.

Notwithstanding the great variety of different constructions of the steam-engine, they all derive their force from one of these two principles, or from the combination of the two; but before entering upon any description of the manner in which these forces are applied, it is necessary to have clear ideas of the nature of steam, and of the law by which it expands by heat, in order to form a precise judgment of what praises in the interior part of a steam-engine when it is at work. In the common acceptance of the word steam, it is that hot white vapour which we see every day rising in a cloud from a tea-kettle or boiling-pot; but this is not exactly the state of the steam employed in an engine; it is there perfectly transparent, and is more or less hot than boiling water, according as it is retained under a lesser or greater degree of preffure. The ordinary preffure of the atmosphere, bearing upon the surface of water, will retain it in a state of fluidity, until it is heated to what is generally called the boiling point, and is marked $212^\circ$ in Fahrenheit's thermometer. If the heat is increased above that degree, and if the water is unconfined, except by the preffure of the atmosphere, the water immediately assumes the aeriform state, and flies off in elastic vapour, which we call steam; but if the same water is relieved from the preffure of the atmosphere by enclosing it in a close vessel, and exhausting the air from it, a certain portion of steam or vapour will rise from the same at any temperature, even when it is as low as freezing; and if this vapour is conveyed off from the vessel as fast as it rises, the water, although cold, will boil, and such vapour will rise as fast as the boiling kettle does in the open air. If the vapour is retained in the vessel, it will only accumulate, until it has acquired a certain degree of elastic force to press upon the surface of the water, which will then cease to yield any more vapour, until the heat is further increased, or that the vapour is drawn off to relieve the water from the preffure which confined and retained it in its fluid state. On the other hand, water which is retained in a close vessel, under a greater degree of preffure than that occasioned by the pressure of the atmosphere, will not boil or rise in vapour, until it becomes heated to a higher temperature than $212^\circ$. It is even probable, that water might be compressed to that degree, that it would not boil until heated red-hot; but this would require such an enormous strength in the vessel which should contain the steam, that it is far beyond the practicability of an experiment.

In this manner the reader is to bear in mind, that vapour or steam, when confined in close vessels, is always more or less elastic, in proportion to the degree of heat which is applied to it; or, in other words, that the temperature of the steam is an exact index of the elastic or expansive force with which it presses upon the surface of the water, and against the interior surface of the vessel which contains it.

The following tables shew the law by which the expansive force increases with the increase of the temperature. They were made from the experiments of Mr. John Dalton, which he published at length in the "Memoirs of the Literary and Philosophical Society of Manchester," and experiments have been also made in France by M. Betanier. The preffures in the following tables, do not differ from those in the preceding table so much as to affect the results in any great degree, when applied to practice, in calculating the force of steam-engines. These experiments were made by enclosing water in a clove vessel, from which the air was carefully exhausted, so as to make a vacuum. A thermometer was applied, so as to indicate the
STEAM ENGINE.

The temperature of the interior of the vessel; also there was a communication made from the vessel to the lower part of a fihon barometer tube, that is, an inverted glass fihon filled with mercury, from one leg of which the pressure of the atmosphere was excluded, and the other leg communicated with the interior of the vessel. In this way, when there was a vacuum in the vessel, the surface of the mercury in the two legs of the fihon would stand at the same level, because it would not be pressed upon at all on either side; but when any vapour was raised in the vessel, it would press upon the interior surface thereof, and also upon the surface of the mercury in one of the legs of the inverted fihon; and as the surface of the mercury in the other leg would not be pressed upon at all, the mercury would mount in one leg and descend in the other, and the difference of the level between the two being measured, would express the elastic force of the vapour, which was found to increase with the increase of the heat, according to the second column of the table. For the convenience of estimating the force of the vapour, we have added the third and fourth columns to Mr. Dalton's table. The third, to express the pressure by the altitude of a column of water, instead of mercury; and the fourth column to show the pressure upon each square inch of the surface upon which the vapour acts, in pounds anywhere and decimals. The table also shows, in the third and fourth columns, the difference of pressure between the vapour and atmospheric air in three different terms, viz., in the column of mercury, column of water, and in pounds on the square inch.

In the first table, which is for every 10° of temperature up to 212°, or the heat of boiling water when in the open air, the three last columns shew how high the pressure of the atmospheric air, when the barometer is at 30 inches, will force up mercury or water in a tube, which at the upper end communicates with the vessel containing the vapour, and the lower end is immersed in the mercury or water. And in the second table, which is for the degrees of heat above 212°, the same columns shew how high the boiling force of the vapour will cause mercury or water to mount up in a tube, which at the lower end communicates with the vessel containing the steam, and the upper end is open to the atmospheric air.

<table>
<thead>
<tr>
<th>Temperature in Degrees Fahrenheit's Thermometer.</th>
<th>Pressure of the Vapour, or the Force which it will exert to enter into a Vacuous Space.</th>
<th>Pressure of the Atmosphere, or the Force which it will exert to enter into a Space filled with the Vapour. Barometer supposed to be at 30 inches.</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>.01</td>
<td>0 .17</td>
</tr>
<tr>
<td>-30</td>
<td>.02</td>
<td>0 .27</td>
</tr>
<tr>
<td>-20</td>
<td>.03</td>
<td>0 .4</td>
</tr>
<tr>
<td>-10</td>
<td>.04</td>
<td>0 .58</td>
</tr>
<tr>
<td>0</td>
<td>.06</td>
<td>0 .87</td>
</tr>
<tr>
<td>10</td>
<td>.09</td>
<td>1 .23</td>
</tr>
<tr>
<td>20</td>
<td>.129</td>
<td>1 .75</td>
</tr>
<tr>
<td>30</td>
<td>.186</td>
<td>2 .5</td>
</tr>
<tr>
<td>40 (freezing.)</td>
<td>.2</td>
<td>2.7</td>
</tr>
<tr>
<td>50</td>
<td>.263</td>
<td>3.5</td>
</tr>
<tr>
<td>60</td>
<td>.375</td>
<td>5.1</td>
</tr>
<tr>
<td>70</td>
<td>.574</td>
<td>7.1</td>
</tr>
<tr>
<td>80</td>
<td>.721</td>
<td>9.8</td>
</tr>
<tr>
<td>90</td>
<td>1.1</td>
<td>1.56</td>
</tr>
<tr>
<td>100</td>
<td>1.86</td>
<td>2.15</td>
</tr>
<tr>
<td>110</td>
<td>2.63</td>
<td>2.105</td>
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<tr>
<td>120</td>
<td>3.33</td>
<td>3.9</td>
</tr>
<tr>
<td>130</td>
<td>4.34</td>
<td>4.105</td>
</tr>
<tr>
<td>140</td>
<td>5.44</td>
<td>5.6</td>
</tr>
<tr>
<td>150</td>
<td>6.54</td>
<td>6.6</td>
</tr>
<tr>
<td>160</td>
<td>7.64</td>
<td>7.6</td>
</tr>
<tr>
<td>170</td>
<td>8.74</td>
<td>8.6</td>
</tr>
<tr>
<td>180</td>
<td>9.34</td>
<td>9.6</td>
</tr>
<tr>
<td>190</td>
<td>10.44</td>
<td>10.6</td>
</tr>
<tr>
<td>200</td>
<td>11.54</td>
<td>11.6</td>
</tr>
<tr>
<td>210</td>
<td>12.64</td>
<td>12.6</td>
</tr>
<tr>
<td>211 (boiling.)</td>
<td>13.74</td>
<td>13.7</td>
</tr>
<tr>
<td>212 (boiling.)</td>
<td>14.84</td>
<td>14.8</td>
</tr>
</tbody>
</table>

The vapour and the atmosphere equal.
STEAM-ENGINE.

<table>
<thead>
<tr>
<th>Temperature in Degrees of Fahrenheit's Thermometer.</th>
<th>Pressure of the Steam, or the Force which it will exert to enter into a vacant Space.</th>
<th>Pressure of the Steam against the Atmosphere, when the Barometer is at 30 Inches, or the Force which it will exert to escape from the close Vessel into the open Air.</th>
</tr>
</thead>
<tbody>
<tr>
<td>212 (boiling.)</td>
<td>Inches.</td>
<td>Ft. In.</td>
</tr>
<tr>
<td>215</td>
<td>30.</td>
<td>33 10.75</td>
</tr>
<tr>
<td>220</td>
<td>31.83</td>
<td>35 11</td>
</tr>
<tr>
<td>225</td>
<td>34.99</td>
<td>39 6</td>
</tr>
<tr>
<td>230</td>
<td>41.75</td>
<td>47 2</td>
</tr>
<tr>
<td>235</td>
<td>45.58</td>
<td>51 6</td>
</tr>
<tr>
<td>240</td>
<td>49.67</td>
<td>56 1</td>
</tr>
<tr>
<td>245</td>
<td>53.58</td>
<td>60 10</td>
</tr>
<tr>
<td>250</td>
<td>58.81</td>
<td>65 9</td>
</tr>
<tr>
<td>255</td>
<td>62.85</td>
<td>71 0</td>
</tr>
<tr>
<td>260</td>
<td>67.75</td>
<td>76 6</td>
</tr>
<tr>
<td>265</td>
<td>72.76</td>
<td>82 2</td>
</tr>
<tr>
<td>270</td>
<td>77.85</td>
<td>87 11</td>
</tr>
<tr>
<td>275</td>
<td>83.13</td>
<td>93 11</td>
</tr>
<tr>
<td>280</td>
<td>88.75</td>
<td>100 3</td>
</tr>
<tr>
<td>285</td>
<td>94.35</td>
<td>106 7</td>
</tr>
<tr>
<td>290</td>
<td>100.12</td>
<td>113 1</td>
</tr>
<tr>
<td>295</td>
<td>105.97</td>
<td>119 8</td>
</tr>
<tr>
<td>300</td>
<td>111.81</td>
<td>125 4</td>
</tr>
<tr>
<td>305</td>
<td>117.68</td>
<td>132 11</td>
</tr>
<tr>
<td>310</td>
<td>123.53</td>
<td>139 6</td>
</tr>
<tr>
<td>315</td>
<td>129.29</td>
<td>146 1</td>
</tr>
<tr>
<td>320</td>
<td>135.07</td>
<td>152 6</td>
</tr>
<tr>
<td>325</td>
<td>140.70</td>
<td>158 11</td>
</tr>
</tbody>
</table>

History of Invention of the Steam-Engine.—The great elastic force of steam has been long known in the instrument called the aëolipile (see that article); and its property of condensation was also experienced in the use of the same instrument: the manner commonly practised for filling the ball with water being to plunge it into cold water, when heated and filled with steam; by which means the steam is condensed, and forms a vacuum sufficient to draw the water into the ball, although the orifice is so small that water could not be introduced by any other means. At the same time, the true principles of its action were fo little understood, that the steam which issued from it, when placed on the fire, was supposed to be air produced by the decomposition of the water; and nearly all the old philosophers, who have described this instrument, proposed to employ it for blowing furnaces. The first idea of employing this force of steam to produce motion was by Branca, a philosopher of Rome, who contrived a great number of different kinds of mills to be worked by the steam coming from a large aëolipile, and blowing against the floats or vanes of a wheel. We are obliged to this author for a number of other ingenious inventions, which he dedicated to M. Cacci, governor of Loretto, in 1258, and published his work (Le Machine) at Rome the year following. The representation of his fire-machine is given in the twenty-fifth plate; but the force which he could have thus obtained from steam would have been found altogether insconsiderable, if he had ever put it in practice.

The first real steam-engine was invented by the marquis of Worcester; but it was only for raising water, and that by the expansive force of steam alone. The next engine was by captain Savery, and operated, both by the expansive force and the pressure of the atmosphere, to fill up the vacuum which was produced by the condensation of the steam, after it had ceased to operate by its expansion. These actions were employed alternately to raise water. The third inventor, Newcomen, abandoned the force of expansion, and only employed the condensation of the steam to obtain a vacuum, and cause the pressure of the atmosphere to act, unbalanced upon a piston, fitted into a cylinder; and as the force was thus exerted upon a moveable piston, his machine is capable of being applied to give motion to pumps or other machines, whereas his predecessors were obliged to confine themselves to the raising of water. Soon after this invention, engines were proposed with pistons to be actuated by the expansive force of the steam only, without the vacuum. Lastly, Mr. James Watt invented the engines now in general use, which are actuated both by the pressure of steam, and the vacuum acting at the same time upon the opposite surface of the piston.

We owe too much to these inventors, as well as many others, to pass over their discoveries with such flight notice; and shall, therefore, give a detailed history of the progress of this valuable invention, drawn from the best authorities we have been able to obtain.

The Marquis of Worcester's Steam-Engine.—The earliest description
STEAM-ENGINE.

It must be also further considered, that these projects were published at a time when true science was beginning to take place of empiricism.

The Century of Inventions appeared about three years after the establishment of the Royal Society, during the time of Mr. Boyle, Dr. Hooke, Dr. Wallis, sir Christopher Wren, sir Isaac Newton, and others equally skilled in calculations, as in the inventive parts of mechanics.

Under all these circumstances, it is not astonishing that the marquis’s propositions in general should meet with a cool reception, or that this celebrated invention should be condemned to obscurity, amongst the other wonders with which it was accompanied.

We do not wish to be misunderstood, that all the marquis’s propositions, except the fire-engine, are of the same nature as No. 99; on the contrary, several have been re-invented, and proved true, since the marquis’s time; for example, short-hand telegraphs, floating baths, carriages from which the horses can be disengaged if unruly, combination locks, secret eutectheons for locks, candle-moulds, etc. It is also probable that others may be brought to perfection; yet the greater part is so much in the style of the wonderful, that it is to be wished that the marquis had published nothing but No. 63, which at once would have rendered his name immortal, and without any tarnish or alloy to the glory of so great an invention.

Captain Savery’s Steam-Engine.—The next attempt upon record is that of captain Thomas Savery, a commissioner of the sick and wounded, who, in the year 1698, obtained a patent for a new invention for raising water, and occupying motion to all sorts of mill-work, by the impelling force of fire. This patent bears date the 25th July, in the tenth year of the reign of William III., that is 1698. The patent states that the invention will be of great use for draining of mines, serving towns with water, and for working all sorts of mills.

In June 1699, he shewed a working model of his engine to the Royal Society, and in their Transactions for that year, vis. No. 275, vol. xxi. there is the following register:

“Mr. Savery, June 14th, 1699, entertained the Royal Society with shewing a small model of his engine for raising water by the help of fire, which he set to work before them; the experiment succeeded according to expectation, and to their satisfaction.”

The above is accompanied with a copper-plate figure, with references by way of description, from which it appears, that the engine then shewn by captain Savery was for raising water not only by the expansive force of steam, like the marquis of Worcester’s, but also by the condensation of steam, the water being first raised by the pressure of the atmosphere to a given height from the well into the engine, and then forced out of the engine up the remaining height by the expansive force of steam, in the same manner as proposed by the marquis. This action was performed alternately in two receivers, so that while the vacuum formed in one was drawing up from the well, the preasure of the steam in the other was forcing up water into the reservoir; but both receivers being supplied by one suction-pipe and one forcing-pipe, the engine could be made to keep a continual airflow, or so nearly so as to suffer very little interruption.

The inventor afterwards published an account of his engine in a small book, entitled “The Miner’s Friend, or Engine to raise Water by Fire described, and the Manner of fixing it in Mines, with an Account of the several Utensils applicable unto, and an Answer to the Objections made against it,” printed at London in 1704, by Thomas Savery.
STEAM-ENGINE.

man. This little book was separately addressed to king William III., to whom the engine had been shewn at Hampton Court, to the Royal Society, and also to the Mine Adventurers of England, who were invited to adopt the invention.

This engine displays much ingenuity, and is almost as perfect in its contrivance as the same kind of engine has ever been made since that time: we have on that account copied the principal figure, and copied Savery's own description, as given by Dr. Harris, in his Lexicon Technicum. See Plate I. Steam-Engines, fig. 1.

Captain Savery's Description of his Fire-Engine.—A denotes two furnaces, whole fire-places are marked B 1 and B 2, and their common funnel or chimney C.

In these two furnaces are placed two vessels of copper, which I call boilers, the one a larger, as L, the other a smaller, as D.

These boilers have each a gauge-pipe, as G and N, of which G goes within eight inches of the bottom of the small boiler, but N reaches only half way down into the great boiler.

By these pipes, before the engine can work, you must fill the small boiler quite full, and the great boiler two-thirds full of water. Then light the fire under the large boiler at B 1, and make the water therein boil, by which means the steam of it being quite confined must needs be wonderfully compressed, and therefore will, on the opening of a way for it to issue out (which is done by pushing the handle Z of the regulator from you), rush with a great force through the steam-pipe O 1, into the receiver P 1, driving all the air before it, and forcing it up into the force pipe through the clack R 1, as you will perceive by the noise and rattling of the clack; and when all the air is thus driven out, the receiver P 1 will be very much heated by the steam. When you find it is thoroughly emptied, and is grown very hot, as you may both see and feel, then pull the handle Z of the regulator towards you, by which means you will stop the steam-pipe O 1, so that no more steam can yet come into the receiver P 1, but you will open a way for it to pass into O 2, and by that means fill the other receiver P 2 with the steam, as the other was before.

While this is doing, let some cold water be poured on the first-mentioned receiver P 1, by which means the steam in it being cooled and condensed, and contracted into a very little room, and consequently prelling but very little (if at all) on the valve or cock R 1, at the bottom of the receiver P 1, there is nothing there to counterbalance the preffure of the atmosphere on the surface of the water, in the lower part of the sucking-pipe T, wherefore it will be preffed up, and ascend into, and fill the receiver P 1, driving up before it, as it rises, the clack or valve R 3, which afterwards falling down again and shutting close, hinders the descent of the water that way.

Then (the receiver P 2 being in the mean time emptied of its air) push the handle of the regulator from you, and the force of the steam coming from the boiler, will act upon the surface of the water contained in the receiver P 1, where it forces or preffes hard upon it, and still increases its elasticity or spring until it exceeds the weight of the column of water in the receiver and pipe S, which then it will necessarily drive up through the passage Q R 1, Q O 1, into the force-pipe S, and at last discharge it out at the top, as is represented in the figure.

After the same manner, though alternately, is the receiver P 1 filled and emptied of water, and by this means a regular stream is kept continually running out at the top of the force-pipe S, and so the water is raised very easily from the bottom of the mine, &c. to the place where it is designed to be discharged.

"Only I should add, that after the engine begins to work, and the water is riven into and hath filled the force-pipe S, then it fills also the little ciffern X, and by that means feeds the pipe Y Y, which I call the-feeding-pipe, and which can be turned sideways over either of the receivers, and be then be open: by this cold water is conveyed down from the force-pipe to fall upon the outsides of the receivers when thoroughly heated by the steam, in order to condense the steam within, and make them suck (as it is usually called) the water out of the well up into the receiver.

"Also a little above the ciffern goes the pipe E, to convey water from the force-pipe into the leffer boiler D, for the purpose of replenishing the great boiler L, when the water in it begins to be almost consumed. Now when there is need of doing this, turn the cock E, so that there can be no communication between the force-pipe S and the leffer boiler D; and putting in a little fire under the small boiler B 2, the water shall there grow presently hot; and when it boils, its own steam, which hath no vent out, prelling on its surface, will force the water up the pipe H, through X, into the great boiler L, and so long will it run till the surface of the water in the boiler D gets to be as low and at the bottom of the pipe H, and then the steam and water will run together, and by its noise, and rattling of the clack L, will give him that works the engine sufficient assurance that the small boiler hath emptied and discharged itself into the greater one L, and carried in as much water as is then necessary; after which, by turning the cock E again, you may let new cold water out of S into the leffer boiler D, as before, and thus there will be a continual motion and a continual supply of the engine, without fear of decay or disorder.

"Also, to know when the great boiler wants replenishing or not, you need only turn the gaug-box N, and if water come out there is no need to replenish it, but if steam come only, you may conclude there is want of water; and the like will the cock G do in reference to the leffer boiler D, shewing when it is necessary to supply that with fresh water from S; so that in working the engine there is very little skill or labour required; it is only to be injured by either a stupid or wilful neglect.

The engine above described does not differ essentially from that represented in the print in the Philological Transations, but it is more nearly put into form, and improved in some of the minor particulars. For instance, the original engine had only one boiler, and there was none of supplying it with water, to replace the waste occasioned by the evaporation of the steam, without stopping the action of the engine whenever the boiler was emptied to such a degree, as to r ilk the burning of the vellis. And after the boiler was replenished, the engine could not begin to work again, until that water which was introduced cold was made to boil.

The engine which we have just described from the Miner's Friend has a subfdary boiler, in which a quantity of water is reduced to a boiling heat in a few minutes for supplying the great boiler, and the power of the steam raised in the subfdary boiler is employed to force the water contained in it into the other, or great boiler, which actuates the engine; by this means the transposition of the feeding water is not only infantly performed, but being at a boiling heat, it is immediately ready to produce steam for carrying on the work. There is also another great improvement in the construction of this engine. His steam engine was worked by four separate cocks, which the operator was obliged to turn
STEAM-ENGINE.

turn separately at every change of stroke; and if he turned them wrong, he was not only liable to damage the engine, but he prevented its effect, and lost a part of the operation; whereas in this second engine the communications are made by the double sliding-valve, or regulator, as it has since been called. This is a brass plate, shaped like a fan, and moving on a centre within the boiler, so as to slide horizontally in contact with the under surface of the cover of the boiler, to which it is accurately fitted by grinding, and thus at pleasure opens or shuts the orifices or entries to the steam-pipes of the two receivers alternately. This regulator acts with less friction than that of a cock of equal bore; and by the motion of a single handle backwards, at once opens the proper steam-pipe from one receiver, and closes that which belongs to the other receiver.

The contrivance of the regulator has since proved of more consequence, as having been universally adopted in the cylinder engines.

Captain Savery, in the Miner’s Friend, above referred to, in addition to the description of his engine, enumerates the following uses to which it may be applied, and which he describes rather fully, as follows: viz. 1st. To raise water for turning all sorts of mills; 2dly, supplying palaces, noblemen’s and gentlemen’s houses with water, and giving the means of extinguishing fires therein, by the water so raised; 3dly, the supplying cities and towns with water; 4thly, draining swamps and marshes; 5thly, for ships; 6thly, for draining mines of water; and 7thly, for preventing dams in the said mines.

Dr. Harris, in his account of the fire-engine, speaks of captain Savery as one that he was acquainted with, and as a person of great merit and ingenuity. He first mentions another machine of Savery’s, for rowing a ship in a calm by paddle-wheels placed at the vessel’s side, of which the captain published an account in 1698; and it is worthy of remark, that the same kind of wheels, when actuated by improved steam-engines, is the only method, amongst an infinite number of others, which at present has been found to answer for rowing vessels. Dr. Harris, in proceeding to the fire-engine, says, “The other engine is for raising water by the force of fire, in which he has shewn as great ingenuity, depth of thought, and true mechanic skill, as ever discovered itself in any design of this nature.” Notwithstanding this, Dr. Defaguiers has endeavoured to take away all the merit of the invention of the fire-engine from captain Savery, as if he had merely copied it from the marquis of Worcester.

The account given by Dr. Defaguiers has been so frequently copied by different writers, that it is generally considered as correct; and we therefore think it a piece of justice to the memory of captain Savery, to set his pretensions in a clearer light than has been generally done. The doctor says, “Captain Savery having read the marquis of Worcester’s book, was the first who put in practice the raising water by fire, which he proposed for the draining of mines. His engine is described in Harris’s Lexicon, (see the word Engine,) which, being compared with the marquis of Worcester’s description, will easily appear to have been taken from the book, with captain Savery denied it; and the better to conceal the matter, bought up all the marquis of Worcester’s books that he could purchase in Paternoster-Row, and elsewhere, and burned them in the presence of the gentleman, his friend, who told me this. He said that he found out the power of steam by chance, and invented the following story to make people believe it; viz. that, having drank a flaks of Florence at a tavern, and thrown the empty flaks upon the fire, he called for a basin of water to wash his hands; and perceiving that the little wine left in the flaks had filled up the flaks with steam, he took the flaks by the neck, and plunged the neck of it under the surface of the water in the basin, and the water of the basin was immediately driven up into the flaks by the pressure of the air. Now he never made such an experiment then nor designedly afterwards, which I thus prove — that in the experiment published about half a flaks of wine in a flaks, which I laid upon the fire till it boiled into flaks; then putting on a thick glove to prevent the neck of the flaks from burning me, I plunged the mouth of the flaks under the water that filled a basin, but the pressure of the atmosphere was so strong, that it beat the flaks out of my hand with violence, and threw it up to the ceiling. As this must also have happened to captain Savery, if ever he had made the experiment, he would not have failed to have told such a remarkable incident, which would have embellished his story.”

This conclusion of the doctor’s is altogether unphilosophical, and does not at all invalidate captain Savery’s account. We know that the marquis of Worcester gave no hint concerning the contrivability or sudden condensation of steam, upon which all the merit of the modern engine depends. The marquis of Worcester’s engine was actuated wholly by the elastic power of steam, which he either found out, or proved by the bursting of a cannon, in part filled with water; but he gave not the least hint that steam so expanded is capable of being again so far contracted in an instant, as to leave the space it occupied in a vessel in a great measure a vacuum. This grand discovery was referred to captain Savery, and his account of its accidental origin is not at all improbable. The captain tells us in the Miner’s Friend, that he did not bring his design to bear, until after a great number of fatiguing inquiries; and he actually erected several machines before he obtained his patent in July 1698. Many objections were made against the grant of that patent being passed; but in the hearing of these objections, the discovery of the marquis of Worcester’s prior claim was not mentioned; and, indeed, it is certain that the account given in the Century of Inventions could not instruct a person who was not sufficiently acquainted with the properties of steam to be able to invent the machine himself.

Defaguiers seems to have been too hasty in concluding that the captain had never made such an experiment as that of the wine-flask, because, in the single instance in which he tried it himself, he found the effect of the condensation took place in a much higher degree than reported by the captain. It is not difficult to conceive that a very small difference in the heat of the steam which filled the flask, and other circumstances, might create the whole of the difference in the result. And, on the whole, there is no reason to hesitate in believing that the captain actually took his hint of the condensation of steam from such an accident, and being of a very mechanical genius, he would naturally turn his thoughts towards the consideration of such a power; and the most obvious application of it would be to a machine on a construction similar to that described by the marquis. Or, if he really had been acquainted with, and considered the marquis of Worcester’s engine, he would easily see that the new principle of condensation might, with great advantage, be combined with the former, and thereby produce an effect more powerful than either of them could do alone. The only thing in the doctor’s account which cannot now be disproved is, that captain Savery destroyed the marquis of Worcester’s books. Even if this is true, it may be accounted for that the captain must, first or last, have become acquainted with what had been before made public by the marquis of Wor-
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eater; and after having in his books spoken of his invention, and his new power or cause of motion, and finding the marquis's inventions to be but little known, he might be tempted, in order to secure the whole credit and expected advantage to himself, to buy up the marquis's books and burn them. But the grounds for this assertion are very slight, and will never prevent the conclusion, that the great principle of obtaining force from the prehure of the atmosphere, by the condensation of the steam of boiling water, was a discovery for which we are indebted to captain Savery, who had also the merit of first reducing it to practice in a most complete manner, in combination with the prior discovery of the marquis.

M. AMONTONS' FIRE-WHEEL.—The French writers who have treated of the steam-engine, seldom fail to mention Papin and M. Amontons as the first inventors of the method of raising water by steam, and speak of Savery as a person who put their ideas in execution, and brought them to perfection: we think it right on this account to relate what was done by M. Amontons and Papin, although the attempts of the latter to employ the force of steam are not entitled to any notice, either from their originality, or from their real merit. It is probable, that the news of the patent granted to Savery in 1698, for raising water, and occasioning motion to mill-work by the impelling force of fire, excited the attention of the French academicians, before the means by which it was to be accomplished were made public, so as to be known abroad, and that they were thus induced to attempt the same thing. For in June 1699, which is the same month that captain Savery flew his machine at work before the Royal Society, M. Amontons delivered a memoir to the Royal Academy of Sciences at Paris, entitled “A commodious Way of Substituting the Action of Fire instead of Men and Horses to move Machines.”

This may be regarded as the first attempt to produce a circular motion by the means of fire, otherwise than by the aëolipile, or the fly of a smoke-jack: but as the motion of M. Amontons' wheel was to be produced by the alternate dilatation and contraction of air, and not of the steam of boiling water, it is nothing in common with Savery's machine, except that the first cause of motion is that of fire.

M. Amontons' fire-wheel, as he called it, consists of a number of close buckets, or chambers, placed in the circumference of a hollow wheel, and communicating with each other by valves opening in one direction; and a sufficient quantity of water is put into these buckets to fill about one half of the number: another circle of similar buckets, but of larger dimensions, are placed on the outside of the circle of the former buckets; these large buckets contain air, and each one has a pipe conducted from them to one of the water-buckets which are nearer to the centre: a part of the circumference of the wheel, which is about the level of the centre, is exposed to the fire of a furnace, so that each air-bucket that passes will be heated; and also the lower part of the wheel is immered in a cistern of cold water, so as to cool the same bucket again. The action of the machine may easily be understood. The air contained in the large bucket which is opposite the fire becomes heated and expanded, and by the pipe of communication it is forced into that water-bucket which is at the lower side of the wheel, and preffing upon the surface of the water therein, causes it to mount up through the other chambers, in the direction in which the valves open from one chamber to the next; the water, being thus accumulated in the chambers at one side of the wheel, will give it a preponderating power to turn round upon its axis. This motion brings another air-bucket opposite to the fire, and the air therein expands in its turn, and again elevates the water in the interior chambers as much as it had been heated by the motion of the wheel; a continual succession is thus kept up, and the air-buckets which have passed the fire descend into the cold water, and the air is thereby cooled and reduced to its former bulk. By the communication with the water-buckets, the prehure of the expanded air is removed from within them, and puts them in a state of contraction to repeat their action.

This machine is ingenious, and if a better application of fire, by rareifying water into steam, had not been discovered, it is possible that the invention of M. Amontons might have been further prosecuted. From his computations it would appear, that the machine he proposed would act with a considerabler power; but as he exhibited no working model, or actual trial, it was never proved that the machine, if put into practice, would be capable of producing anything near the effect promised by his calculations. Leopold, in his "Theatrum Hydraulicum," 1724, proposed an improved form of this fire-wheel; and steam-engines have been since made with mercury, or fluid metal, contained within a hollow wheel, which is to be always kept on one side with the mercury by the force of the steam; they have not been found to equal other modes of applying the force of steam. Such of our readers as are curious to know more of the construction of M. Amontons' machine, can consult the original memoir; and they will also find a full account of it, with a figure, in Martin and Chamber's Abridgment of the Philosophical History and Memoirs of the Royal Academy of Sciences at Paris, vol. I.

Papin's Pretensions to the Invention of the Steam-Engine.—M. Papin, to whom the French attribute the invention of the steam-engine, was a doctor of physick, and professor of mathematics at Marburg, in Germany, and in 1680 he was elected a fellow of the Royal Society of London. In the following year, and whilst in London, he invented and published a method of dissolving bones, and other animal solids, in water, by confining them in close vessels, which he called digesters, and which he made sufficiently strong to retain the steam and prevent all evaporation, so as to acquire a great degree of heat. About the same time Dr. Hooke, the most inquisitive experimental philosopher of that inquisitive age, observed that water could not be made to acquire above a certain temperature in the open air, and that as soon as it begins to boil, its temperature remains fixed, and an increas of heat only produces a more violent ebullition, and a more rapid waffe. Papin's experiments with his digester rendered the elastic power of steam very familiar to him, and when he left England, and settled as professor of mathematics at Marburg, he made many attempts to employ this force in mechanics, and even for raising water.

By his own account, it appears that he had made some experiments with this view in 1698, by order of Charles, landgrave of Hesse, but without effecting anything. This is all the reason the French have to consider him as the first inventor of the steam-engine. Nine years after Savery's patent he published an account of his invention, in a tract, entitled "Ars nova ad aquam ignis admiculum efficacissime elevandam"—"A New Method of raising Water by the Force of Fire," printed at Cael, 1707. This machine, which is described in Belidor's "Architecture Hydraulique," vol. ii. does not essentially differ from that of the marquis of Worcester; but is far less perfect than Savery's: it works wholly by the repellent power of steam; the only advantage is, that the receiver being made cylindrical, the steam is separated from the cold water by a floating piston, and that the water is made to flow in some degree coolantly, by being thrown into a large air-vessel. In this publication, Papin admits
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admits that he had seen a draft of Savery's engine, but says, that in the year 1698 he made a great number of experiments, by order of his serene highness Charles, landgrave of Hesse, in order to raise water by the force of fire, which he communicated to several persons, and particularly to M. Leibnitz, who answered, that the same thought had occurred to himself. He also acknowledged that captain Savery was about that time working upon the same subject in England, and that Savery had first published the fruit of his researches; that from 1698 the affair had lain dormant till the year 1705, when he received a letter from M. Leibnitz, then in London, which contained a draft of captain Savery's engine, and defied Papin's opinion upon it. He showed this draft to the landgrave, he ordered Papin to refuse the work, and perfect the inventions which he had begun; and which Papin then published, not with a view to make it suppos'd that captain Savery had taken the thoughts from him, but to show the world its obligation to the landgrave, in having first formed a design so useful, and in having brought it to its present degree of perfection; and he labours much to show that his engine is preferable to that of captain Savery. Although we must allow Dr. Papin to compliment his patron and himself upon the successe they met with, after encountering many unforeseen difficulties and experiments, which succeeded, as he tells us, quite contrary to their expectations; yet it cannot be denied that the experiments put in 1698 were the first, because the marquis of Worcester's publication was earlier by no less than thirty-five years; nor were they probable to have been so early as Savery's beginning, since we cannot suppos'd that he would be at the expense of a patent, without some previous experiments to confirm his speculations, or that he could bring his engine to the degree of perfection in which he exhibited it to the Royal Society on the 14th of June, 1699, in less than a year, at a period when workmen were not ready or skilful in the execution of such machines.

We have copied the figure of Papin's engine from Belidor, that our readers may be able to compare it with captain Savery's, and judge of the authority upon which M. Boffill has laid in his Hydromatique, that the first notion of the steam-engine was certainly owing to Dr. Papin, who had not only invented the digester, but had, in 1695, published a little performance describing a machine for raising water, in which the pistons are moved by the vapour of boiling water, alternately dilated and condensed. Now the fact is, that Papin's publication on the steam-engine was in 1705, in which is contained the invention to Savery. He had occasionally before that published several inventions in the Acta Eruditorum, in which cylinders and pistons were to be employed, but they were not intended to be worked by steam, but by gunpowder and air, as we shall shew hereafter.

Description of Papin's Engine.—The intention of Papin's steam-engine was to turn a water-well by a stream of water issuing with violence from an aperture or jet, the force of steam being employed to throw the water into an air-veisel, from which it was to issue by the re-action of the compressed air. A vessel of wood, $A$, (6) in which the lower axis is supposed to be 36 inches, and the letter axis 20 inches, is placed in a furnace, so that the fire can surround every part: this veisel or boiler, which is made of copper, should be two-thirds full of water, which is introduced by a tube $B$; a fiphon, $C D$, communicates from the boiler $A$ to a cylinder $G H$, of 20 inches in diameter, and about the same in height, which performs the office of the barrel of a pump, and which moves a copper'piston, $S T$, made hollow within, so that it may float upon the water: the base of this cylinder, which has no bottom, is joined to the extremity of a curved tube, $I K O$, which goes through the bottom of another cylinder, $M N$, of three feet in height, and 23 inches diameter, which is closed at all parts, so that the air cannot enter. A veisel $Y$, made like a funnel at the top, is adapted to the tube $I K O$, and serves to introduce water into the body of the pump $G H$, beneath the piston $S T$, which water can never rise above the piston. A cock at $E$ alternately opens and shuts the communication through the fiphon $C D$, between the boiler $A$, and the body of the pump $G H$. When the communication is open, the steam formed in $A$ passes into the upper part of the body of the pump, and preffes the piston, which displaces the water: this water cannot return into the veisel $Y$, because a valve at $R$ prevents it; it therefore rises by the tube $I K O$, and discharges itself into the cylinder $M N$, where it fills a part of the space occupied by the air contained in that cylinder, which, in consequence, acquires a great elaticity.

As soon as the piston is arrived at the bottom of the body of the pump, the cock $F$ is to be shut, to stop the passage of the steam, and another cock, $P$, at the top of the body of the pump, is to be opened, to permit the escape of the steam which has performed its office; then the weight of the water with which the veisel $Y$ is always filled, opens the valve $R$, and introduces itself into the body of the pump $G H$, and makes the piston $S T$ to rise up again: the water contained in the tube $K O$ is to be removed, because a valve at $K$ prevents it from descending. When the water which is introduced into the body of the pump is come to an equilibrium with the water in the veisel $Y$, the cock $P$ is to be shut, and $E$ is to be opened; the steam comes again to press on the piston, which it forces to descend, and, as in the former instance, expels the water through the tube $K O$ into the cylinder $M N$, where it cannot introduce itself without surmounting the resistance arising from the elaticity of the air of which it comes to occupy the space.

The cylinder $M N$, which is three feet high, can contain about 86 cubic feet of water, or about 2.86 cubic feet at every foot in height; therefore, when it is filled to within two feet of the top, the air will be reduced to occupy only one-third of the space in which it was at first shut up, and it will have acquired an elaticity capable of making it subtant a column of water of 64 feet, in addition to the 32 feet with which it is in equilibrium in its ordinary state of compresion; under these circumstances, if the cock $Q$ is opened, the water will fly out, at the first instant, with the same velocity as if it was 64 feet high in the cylinder $M N$; but by degrees, as the water passes out, it will be driven with less velocity, because the air occupying a greater space, its elaticity diminishes; but according to Papin's statement, there should always be at least a foot of water in the cylinder, and the air, in its smallest condensation, should not occupy more than one-third of the space which it occupies in its natural state; and in that case it will have a sufficient pressure to sustain a column of 16 feet of water.

M. Papin's machine is, on the whole, far inferior to the engine of captain Savery, and it wants the advantage of the grand principle of condensation, and is only a return to the marquis of Worcester's idea: it cannot therefore be called an improvement on Savery's, although it must be allowed that the separation of the hot steam from the cold water by a diaphragm, piston, or float, is a considerable improvement on the marquis of Worcester's, and would be also an advantageous addition to Savery's, if the condensing water could be as well applied to run down the outside of a cylindrical veisel as an oval one.

Long after Papin's publication, some English engineers made this addition to captain Savery's engine, and attempted
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to introduce it in opposition to the cylinder or atmospheric engines, for which we shall hereafter speak; but the consumption of fuel was too great to balance the advantage of simplicity in the structure of the engine.

Captain Savery must have been employed a considerable time with his machine prior to the 14th of June 1699, and even previous to his patent, as may be inferred from his Miner's Friend, printed in the year 1702, where, in his address to the Royal Society, he says, that since the time he exhibited his model to them, "I have met with great difficulties and expence to instruct handicraft artificers to form my engines according to my desire; but my workmen, after much experience, are become such masters of the thing, that they oblige themselves to deliver what engines they make me exactly tight, and fit for service, and as such I dare warrant them to every body that has occasion for them."

In his address to the gentlemen adventurers in the mines of England, he says, that the frequent disorders and cumber-omenes of water-engines then in use "encouraged me to invent engines to work by this new force; that though I was obliged to encounter the oddity and almost insuperable difficulties, I spared neither time, pains, nor money, till I had about completed them."

Application of Savery's Engines, and its Defects.—Respecting the real use which was made of Captain Savery's invention, it appears that a number of small engines were erected, under the authority of the patent, for the supply of noblemen's and gentlemen's seats in different parts of England, and for such purposes they succeeded very well; but for the supply of towns, and the drainage of mines, where large quantities of water, and great perpendicular preffures were required, they were not well adapted. With respect to the raising water for turning mills, an application wheroe really suggested itself to the ingenious inventor, we do not think it was ever attempted, for at that period there were scarcely any mills which could have supported the expense of the erection, and maintenance of such engines, even where coals were cheap.

For the drainage of fields they were not well adapted, because the height to which water is most generally required to be raised in such cases is small, and the quantity very great; on this account several engines would always be wanted for one drainage, and a great part of the power would be lost, because the perpendicular height would be very much less than the height to which the atmosphere would raise the water. To ships we may conjecture that they never were applied, and this reduces their use to a very small compass.

The principal reasons why they could not be so generally employed in mines as the captain was led to expect, and which he laboured to bring about, was, that the working part of the engine must necessarily be placed from 2: to 26 feet above the bottom of the mine; and if, by any accident, the water should happen to rise above that level, the engine would be drowned and irrecoverably lost, without some other engines to recover it.

As the power of suction in this engine cannot extend more than 26 feet, the rest of the perpendicular lift must be obtained by the expansive force of the steam; and for every 33 or 34 feet of altitude of this column, a preffure equal to the atmosphere must be exerted on the inside of the boiler and receivers, tending to burst them open.

It is not uncommon, in the calculation of engines, to force the water by steam of more than three atmospheres' preffure, or about 67 feet above the engine; and this limits the whole power of an engine, on Savery's plan, to about 90 feet.

On this account it would require a separate engine for every 14 fathoms of the depth of a mine, and they must raise from one to another; but if any one engine is disregarded, the rest must stop likewise.

Another difficulty was in the quantity of water which could be raised with safety; the size of his largest boiler did not exceed 30 inches diameter, and the capacity of the receiver could be but small; and, therefore, the generality of mines would require more than one engine at the same level. The charge, trouble, and difficulty, attending such a number, would naturally prevent their introduction, even in cases where they would really have been of great service. Add to this, the consumption of fuel in Savery's engines was enormous, compared with the modern engines; and they were always in danger of blowing up, particularly when they were employed to raise water to any considerable height.

Suppose, for instance, the water is to be raised 100 feet; 25 may be done by suction, and the remaining 75 feet must be lifted by the force of the steam. To effect this, the preffure within the vessel must be more than three atmospheres; and it will be seen by our table, that every square inch of the interior surface of the boiler and receiver will be preffed with a force of more than 35 pounds, tending to burst them open. This moderate height will, therefore, require very strong vessels, and all the joints must be made with the greatest care; for although it is true that the preffure is much less than is usual in pumps, and other hydraulic machines, in which there is a greater column of water, yet there is much greater danger of the vessels being burst by steam of such great elasticity, than by an equal preffure of a column of water; because the force of the steam is always liable to be suddenly increased to a very great extent, on any acccident of the heat; and that tends to weaken the vessels, particularly the boiler, which sooner or later must be reduced in thickness at the bottom, and will then burst.

According to Mr. Dalton's experiments, from which we have formed our tables of the expansive force of steam, it must be heated to a temperature of 287° of Fahrenheit's thermometer, before it can overcome a column of water of 75 feet in altitude; and as this steam must come immediately in contact with the surface of the cold water in the receiver, which is perhaps as low as 40°, the condensation of the steam is excessive for some time, and must cool, until the surface of the water acquires nearly the same temperature as the steam; which, however, it will soon do, because the heat is transmitted downward very slowly in fluids. When the surface of the water is sufficiently heated, the steam, which before was condensed as frost as it came in contact with the water, will begin to preff upon the water; and as the heat and elasticity increase, it will lift the column. But when it has expelled all of the water from the receiver, a new course of condensation is produced, from the cold surface of that part of the receiver which was before filled with the cold water; and this condensation will be much more rapid than the former, because the vessel, being necessarily made of metal, will transmit the heat more rapidly than the water did, and delay the process of forcing out the water until the interior surface of the receiver is made as hot as the steam. Captain Savery seems to have been fully aware of this, as he says in the "Miner's Friend," that you may see on the outside of the receiver how the water goes out, and that as far as it is transparent; or as far as the steam is contained within the vessel, so far it is dry without, and so hot as fercerly to endure the least touch of the hand; but as far as the water is, the said vessel will be cold and wet where any water has fallen on it, which cold and moisture
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vanish as fast as the steam, in its descent, takes the place of the water. Also, he says, the force of the steam presses upon the surface of the water, which surface, being only heated by the steam, it does not condense.

Improvement upon Savery's Engine.—The rapid condensation which must take place, when steam of a great elastic force is brought into immediate contact with the water, is an insuperable bar to the raising of water to any considerable height, on Savery's plan. The most obvious improvement was to employ a cylindrical receiver, with a floating piston, in the manner of Papin's; but this was only a partial remedy, because the condensation from the sides of the vessel still took place; and it was not until the piston was made to fit exactly into the cylindrical receiver, and the water kept out of it altogether, that the steam-engine was rendered an efficient machine. But this change, which was invented by Newcomen, introduces much complexity into the work. It becomes necessary to have a separate receiver, with a piston, or, in other words, a pump, to raise the water, and also machinery to communicate the motion of the steam-piston to that of the pump. The simplicity of Savery's engine, and the certainty of its action, rendered it very desirable to obviate its defects so far that it could be employed for mines, even after the more perfect engines were introduced. To avoid returning to the description of Savery's engine, we shall give a brief account of these attempts, before proceeding to the other engines.

The first improvement of Savery's engine was to introduce a small jet of cold water into the inside of the receiver, to perform the condensation, instead of throwing cold water upon the outside of the receiver; by this means a more perfect condensation is obtained, and with less waste of cold water than by the original plan. The water is conveyed by a small pipe, which branches out from the great forcing-pipe, and enters into the receiver, where it turns down, and terminates with a ball, perforated in all directions, like the spout of a watering-pot, so as to disperse the water in a shower within the receiver. A cock is placed to stop the communication at pleasure; and this cock is opened to admit the cold water, when the steam is to be condensed. But it must be observed, that water cannot enter through this cock into the receiver the first instant that it is opened, because the prelude of the water in the force-pipe must be less than that of the steam within the receiver, and, therefore, the injection will not commence until after the steam-cock is shut, and then the condensation, or loss of heat, which always takes place within the receiver from the coldness of the water, will very soon diminish the heat, and consequently the prelude of the steam far off, that it will no longer balance the prelude of the fame column of water, which it had just before lifted into the force-pipe. This being the case, the injection-water begins to run, and falls in a shower through the steam contained in the receiver. The sudden effect of this shower to produce the condensation is really surprising. The injection, being a portion of the fame water which has just before quitted the receiver, must have the same temperature as that which was then in contact with the steam; and the difference in the rapidity of the condensation arises only from the dispersion of the water into drops. When the cold water is contained in the lower part of the vessel, the surface only of the water is exposed to the steam, and soon becomes so heated that it will not condense with that great rapidity which it does at first. On the other hand, a quantity of water dispersed in drops will be completely exposed to the steam, and will take up therefrom, in an instant, as much heat as will reduce the temperature of the steam, and increase the heat of the injection-water, until they approach to an equality of temperature. This being the case, it will easily be seen that the degree of condensation which can be obtained within the receiver will be in a ratio to the coldness and quantity of the injection-water; but the quantity required for injection is far less than when applied on the outside of the receiver, because the receiver will not transmit the heat of the steam through it so quickly, but the water must run down the outside of the receiver, and descend into the well, without being much warmed, and without having extracted much heat from the steam within.

The next improvement in Savery's engine was the addition of the safety-valve to the boiler. This was invented by Papin for his digester, to permit the steam to escape from the boiler into the open air, when it arrives at such a degree of prelude as to endanger the rupture of the vessels. The safety-valve, which is shown in the figure of Papin's engine, fig. 2, is nothing more than a valve opening outwards, and well fitted to close an aperture which is made in the top of the boiler, and is kept shut by a weight or a lever, which is loaded with a weight capable of lifting upon the lever in the manner of a yard; so that the prelude of the weight upon the valve can be regulated at pleasure, according to the strength of steam which is required: but, in all cases, it must be loaded so as to permit the steam to lift it up and escape, when it arrives at a prelude which would endanger the boiler or receiver. With a view to strengthen the boiler, hoops and internal radiating bars were tried, according to the idea of the marquis of Worcester; but this was found of very little service, because, on account of the condensation of the steam, it is much better to divide the mine into engines of from 70 to 80 feet high, according to captain Savery's first proposition, than to attempt using steam of that degree of elasticity, which will require any such precaution.

In the Philosophical Transactions, No. 461, there is an account of a new way of producing steam of a great prelude. The boiler consists of an inverted conical vessel of iron, to the base or upper part of which a close and strong copper-head or hemispheric is joined by rivets all round; this has a copper base, or base, in a reverberatory furnace, to receive a sufficient heat from the flame, without injuring it. The water is introduced into this boiler in a number of small streams, or jets, which are injected into it by a pipe, which descends through the cover, or spherical top, of the boiler; and in the middle of the cone several spouts are fixed, radiating from it like the arms of a wheel: the pipe must be carried up above the boiler, so as to have a column of a sufficient height to overcome the prelude of the steam, and also enter into the boiler with a considerable force; and by the radiating spouts it is dispersed in a shower upon the interior surface of the iron cone, and is thus converted into steam, which flies up to the copper-head, and is carried off by a pipe to the engine. The inventor proposed to make the tube with the radiating spouts to revolve, for the purpose of distributing the water more completely; but he probably never tried the experiment, or he would have found that the boiler would have been soon destroyed by the rapid oxidation of the iron which must take place from throwing water upon it when red-hot; and copper would have melted. In 1719, Dr. Defagurier made an engine on Savery's plan in an improved form. He says, that in considering Savery's engine with Dr. Graveande, they thought there was a great waste of steam, by its constantly acting upon the receivers without intermission, the steam becoming useless until it had heated the surface of the water in the receiver, and also to a certain depth below the surface; but
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if it were so contrived, that after the steam had press'd up one receiver full of water, instead of being thrown into another, it should be confined in the boiler till the receiver was refil'd by the atmosphere, and thus turn'd upon the water, the steam would have acquired so much force from its confinement, that it would press suddenly upon the surface of the water, and discharge a considerable portion of it even before it had heated the surface. In pursuance of this idea, they had a model made which could either be used with one or two receivers, and found, on experiment, that one receiver could be discharged three times in the same time that two could be discharged once. They also learned that captain Savery had made an engine at Kenfonington with only one receiver, which acted very well. Delfaguliers then made several engines with a spherical boiler, provided with a safety-valve, and a receiver of about one-fifth of the capacity of the boiler, and of a cylindrical figure, tall, and of small diameter in proportion. The steam and the injection-water were alternately admitted into the receiver at top through a double-panagled cock, the handle of which being turned towards the boiler, admitted steam; or, being turned towards the force-pipe, admitted the jet of cold water; but only one of these paf-fagled cocks were turned at a time. The small chamber from the force-pipe which conveyed the injection-water to the double-panagled cock, had another cock in it to adjust the aperture, and regulate the quantity of water which should flow into the receiver. The suction-pipe and force-pipe were the same as Savery's; but the valves were conveniently situated, so as to be readily accessible when they required repairs. Dr. Delfaguliers tells us that he made seven of these engines: the first was for the czar Peter the Great, for his garden at St. Petersburgh, where it was set up. The boiler of this engine was spherical (as they were all in Italy where the steam was so much stronger than air), and held between five and fix hogheads; the receiver held one hoghead, and was filled and emptied four times in a minute. The water was drawn up by suction, or the preffure of the atmosphere, twenty-nine feet high out of the well, and then preffured up eleven feet higher. The pipes were all of copper, but foldered to the suction-piece with soft folder, which held very well for that height; but he did not venture either upon a greater quantity for that height, or a greater height for any quantity of water above the boiler. It is a curious experiment to see the behaviour of water as it leaves the boiler. The steam must have been greater, and the steam of the same force would have had a greater surface to act upon, which might have burst the boiler, or would have required it to be made much thicker.

Another engine of this sort, which he put up for a friend in 1730, drew up the water twenty-nine feet from the well, and then it was forced up by the preffure of the steam twenty-four feet higher, into a cistern holding about thirty tons, placed at the top of a tower, in order to run down again through a pipe or conduit, and play several jets in the garden. But sometimes no jets being played, the water was discharged at the height of fix or eight feet out of the force-pipes to fill the ponds and water-meadows in dry weather, which it did with a less strength of steam than what drove the water into the tower; or if the same steam was kept up, it would make eight or nine strokes in a minute, instead of about fix, as when the water was driven up into the cistern. Upon the safety-valve there was a feet of the yard, the place of whose weight showed the strength of the steam, and how high it was capable of raising water; but when the weight was at the very end of the feet of the yard, the steam, being then very strong, would lift it up and go out at the valve, rather than damage the boiler. Twenty-five years after this engine was made, a man, who was entirely ignorant of the nature of the engine, without any instructions, undertook to work it; and having hung the weight at the farther end of the yard, in order to collect more steam, to make his work the quicker, as also a very heavy plumber's iron upon the end of the yard, the steam not being able to lift the safety-valve, the feet of the yard, loaded with all this unusual weight, burst the boiler with a great explosion, and killed the poor man who stood near with the pieces that flew about.

These accounts shew how high, and in what quantity, this kind of fire-engine can safely raise the water. About as much fire as a common large parlour-fire was sufficient to work this engine, and raise fifteen tons per hour; so that if the cistern was kept full, the jets could be made to play to entertain friends at any time, and then a man being sent to light the fire under the boiler, the engine would raise water to supply the jets before the cistern was empty.

M. De Moura, of Portugal, sent an engine to the Royal Society upon the principle of Savery's, but provided with apparatus to make it self-acting, and to open and shut the valves at the proper instant. The receiver, boiler, steam-pipe, and injection-cocks, are the same as we have before described, together with the force-pipes, and their valves. What is peculiar to this engine is, a float within the receiver, composed of a light ball of copper, which is not loose therein, but fastened to the end of an arm or lever, which is made to rise and fall by the float, while the other end of the arm is fixed to an axis, and consequently, as the float moves up and down, the axis is turned round one way or the other. This axis is made conical, and passes through a conical socket, which is foldered to the side of the receiver, and upon that end of the axis which projects beyond the socket; and, therefore, at the outside of the receiver is fitted a second arm, which is also moved backwards and forwards by the axis, as the float rises and falls. By these means, the rising and falling of the surface of the water within the receiver communicates a correspondent motion to the outside, in order to actuate the reft of the gear, which regulates the opening and shutting of the steam and injection-cocks. A small cistern is foldered to the outside receiver, and, being kept full of water, surrounds the joint, or conical socket, through which the axis passes, the float passing both the axis and socket airtight. The cistern is contriv'd so as to keep the water full by means of a small leakage from the force-pipe, through a wooden peg, and the drops are conducted by a packthread down to the cistern. A small weight is applied to the arm on the outside of the receiver, to counterpoise the float within; also upon the same arm is a slider, which being fast nearer to, or farther from the axis, will rise or fall a greater or less space, as may be required; when the float within rises or falls, and the slider can be fastened by a screw at any part. A chain is attached to the slider, and gives motion by means of a shorter chain to a balance, or tumbler, which moves on an axis, and opens and shuts the cocks. The first-mentioned chain passes over two pulleys, supported by two arms, that are fastened to the side of the receiver, which give a chain a proper horizontal direction: in order to move the balance to the end of the chain, a weight is fastened sufficient to raise the balance to a perpendicular position, and also to overcome the friction of the float, and its axis with the pulleys and chain.

The balance moves upon an axis, which is supported in pieces projecting from the receiver; and it has three arms, one of which applies with a roller to the handle of the steam-cock, a second acts upon the lever of the injection-cock,
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cock, and a third short arm has a piece of chain, to
fink the steam to the chain before-mentioned, at the part where the
fame extended horizontally between the two pullies. The
arms, which act upon the cock, are so placed, as to flut
the steam-cock the moment before the injection is opened,
and vice versa.

To put the engine in motion, press down the arm of the
axis, which raises the float within the receiver, and the coun-
ter-weight of the chain will bring the balance over to the
right side, and in its motion will open the steam-cock, and
flut the injection-cock: also open a small gauge-cock in
the top of the receiver, that the air may be dischaged by
the entrance of the stem into the receiver. This being
done, shunt the air-cock, and let go the arm of the balance:
the weight at the end of the chain will bring over the balance
to the left, and in its motion will shut the stem-cock and open
the injection-cock, to admit a small jet of cold water into
the receiver, which presently condenses the steam into water,
in a great measure leaves a vacuum in the receiver. In
this situation the preface of the atmosphere will cause the water
to mount through the injection-pipe into the receiver, where,
as its surface rises, it makes the float ascend, and depriving
the arm on the outside of the receiver, draws the chain and
raises the balance, till it has passed the perpendicular, when
it will fall over suddenly by its own gravity: in falling, the
roller of one of its arms takes hold of the handle of the
stem-cock, and opens it, whilst the other shuts the in-
jection-cock. This fall of the balance takes place when the
receiver is almost filled with water, and the balance cannot
return till the surface of the water therein subside, and suffers
the float to descend. This takes place as soon as the stem
causes to be condened by the cold receiver, and acquires
sufficient elastic force from its heat to fill the receiver and
drive out the water from the forcing-pipe. When the surface
of the water defends the float sinks, and suffers the counter-
weight to draw up the chain. By the short chain it draws
the balance beyond the perpendicular towards the left,
where it falls of its own accord; and in falling, the arm
takes hold of the handle and shuts the stem-cock, whilst the
other opens the injection-cock, as before.

In the "Machines approuvées par l'Academie de 1744," is a
description of an engine by M. Gentilans, which very
closely resembles M. De Moura's, but is more completely
described.

Mr. Blakely's Engine on Savery's Principle.—Long after
steam-engines furnished to Savery, he had become general, an
ingenious engineer, Mr. Blakely, made many attempts to
introduce Savery's engine in an improved form. He obtained
a patent in 1766, from the specification of which it appears,
that his improvement was to employ oil floating upon the
surface of the water in the receiver, to form a piston or diaphragm
between the hot steam and the cold water, to prevent the
steam being condensed as soon as it touches the surface of the
water; or air was to be admitted into the receiver for the
specific purpose. In this case, two receivers were to be
used, one in the same situation as Savery's, which was to
receive the air; and the hot steam, when admitted into it,
forced the air to descend by a pipe to the second receiver,
which was at the bottom of the well, and expel the water
therefrom, and elevate it in the force-pipe. By this means
he hoped to prevent the steam coming in contact with the
water, and avoid the condensation.

Mr. Blakely afterwards made some alteration in the form
of his engine, which is described as follows by Mr. Ferguson:
(See Plate I. fig. 3.) E is the boiler, set in a furnace to be
burnt with flame: F is the gauge-cock, to ascertain the depth of water in the boiler: D the steam
pipe, to which is foldered the cock and funnel C, for filling
the boiler before the engine is set to work: I is an air
vessel, and TT an injection-pipe, which passeth through across
the top of the receiver, and has small holes pierced in it for
the cold water to drop through and fall in a shower in the
air-vessel I, in order to form a condensation: the end of the
injection-pipe is carried into the steam-pipe D, to admit
a small quantity of water to run down the pipe D, and supply
the boiler: V is a receiver, communicating with the air
vessel I by a pipe; in the upper part of it is a callender S,
with small holes to disperse the injection-water, which falls
from the air-vessel I, equally through the receiver V: O is
a valve to admit air, which comes through the cock P into
the receiver: and H is an occasional cock, to let out the air
and steam when the engine is first set to work: Q is a pipe
from the receiver V, to the box which contains the valves B
and N at the bottom of the forcing-pipe A, which conveys the
water up to the reservoir: M is the suction-pipe, to draw
the water from the well up to the receiver: G is the fire
place belonging to the furnace, in which the boiler is set,
and beneath it is an ash-hole. It is needless to say any
thing of the scaffold or the well, they being always made
according to the size of the machine, and in proportion to
the place in which it is to be erected. All the vessels
and pipes of this engine are made of strong copper.

In order to set this engine to work, the receiver A A must
be filled with water, which will be retained in the
clack B; then more water must be poured into the
funnel C, which is on the steam-pipe D; from thence it falls
into the boiler E, and rises to the level of the cock F, which
must be open; but as soon as the water runs from it, the
funnel-cock C, as well as the gauge-cock F, must be shut,
and the air-gauge cock H must be opened. The fire
must then be put into the furnace G, and as soon as the water
is in ebullition in the boiler it creates steam, which finds
its way through the pipe D, and forces the air out of the
vessel I into the lower receiver V; the air is also forced out
at the cock H, the stem following it with great velocity.
In a second or two the cock H must be shut, and instantane
ously the injection-cock L must be opened, which lets cold
water run through the end of the pipe TT, into the steam
pipe D, to replace that which has been evaporated out of
the boiler E; and it also rushes out on all sides from the little
holes which are in the sides of the pipe TT, into the air
vessel I, and falls on the callender S: this cold water makes
ebullition in the boiler E and V, and forms a vacuum, which causes the atmosphere to press on the water
in which the lower end of the pipe N is immersed, and the
water ascends the said pipe with great rapidity, and passeth
through the clack N, and through the pipe Q, into the
receiver V, till it rises up to O, where is a floating-ball sat-
tened to a handle or lever, which in rising turns the key of
the cock P, and opens it; there is a valve at that end of the
cock which is within side of the receiver V, so that as soon
as the cock is opened, the valve O is forced up by the air,
which rushes through with great quickness and noise into
the vessel I; and when that vessel is full of air, the vacuum
is destroyed and no more noise is heard, which gives the
notice to shut immediately the injection-cock L: that being
done, the steam recovers its force, and makes its way
through the steam-pipe D into the air-vessel I; and as the
steam increases, being much lighter than air, it keeps upper
most, and forces the air on the water which is in the
receiver V, which water is forced through the pipe Q, and
lifting up the clack at B, goes with the pipe A, and expels
it into the reservoir M. When all the water is ex-
pelled out of the receiver V, the air follows, and expels
with

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with great velocity through the water which is in the pipe A: two or three seconds after the noise of this is heard, the injection-cock L must be opened to let in cold water, and cause the same effect as before. The noise of the air rushing in and out of the receiver gives proper notice when the manager of this hand-engine is to open and shut the injection-cock, which is the only thing required to work this machine, when once it has been put in motion, in the manner that has been described above.

This engine was not found to answer any better than Savery's, because the air will not make that complete separation between the steam and the cold water which the inventor expected; and there is a great loss of power to compels the air sufficiently to make it lift the column of water; and in order to get rid of this air it must be forced up the pipe, which takes as much power of steam as would be required to force up as much water as the air occupied the place of when in its condensed state. Mr. Blackey's intention in the injection of a small quantity of water into the boiler at every stroke, was the same as Mr. Payne's red-hot boiler, of which we have before spoken, but he was in practice obliged to employ a steam-cock in the pipe D, otherwise the steam which the boiler produces whilst the injection-cock is open would have been all condensed and lost.

Savery's engine can be usefully employed for lifting water 30 or 35 feet, which can be done principally by the suction, and with a very slight preasure for the remainder; but it is the most advantageous way to raise no more than 24 feet, and to perform the whole lift by the suction, and even to allow the water to sufficent amount to enter the receiver by its own gravity, without forcing it in the leaf by the steam. In this form of the engine, the steam need have no greater elastic force than the atmospheric air, or just as much as is sufficient to make it enter into the receiver, as the water runs out. The temperature of the steam, according to our table, will then be only a little above the boiling point, or above 216°, and consequently the loss by the condensation is not so serious; and as the steam is not pressed upon the water, it is not brought into such close contact with the cold water, as in the forcing engines. In this way, the injection must be forced in by a small force-pump.

Mr. Kier's Engine on Savery's Plan.—An engine upon this principle, with various judicious improvements, was erected some years ago by Mr. Peter Kier, at his manufactory of coach axletrees, near Swansea, as it proceeds a little further than the former, and as it allows of more material repair, it has almost constantly been worked since, to raise water and turn a water-wheel. The proprietor states it to answer his purpose very well, because it works without an attendant, and regulates its own motions; and, as might naturally be expected, the wear and tear are also inconsiderable.

Plate I. Steam-Engine, fig. 4, represents this engine, taken in a section through the centre. It represents an oval boiler, seven feet long, five feet wide, and five deep. Mr. Kier confesses it as being of dimensions sufficient to work a larger engine; a circumstance which must, in a certain degree, increase the consumption of fuel. It feeds itself with water conveyed through an elevated pipe, at the end of which is a valve. This valve does not open until the fall of the water within the boiler has suffered a float to subside, which, by its actual weight affixed to draw the valve open; but the float, by its tendency upwards, as the water in the boiler rises, serves effectually to close it. The water in the boiler, therefore, remains constantly at or near the same level. The steam is conveyed by a pipe, T A V, to a box B, through which, by the opening and shutting of a valve, it can be conveyed to the working chamber E. The axis, C, serves as a key to open and shut the valve; N O is a cistern of water, from which the engine draws its water through a vertical pipe, in which the valve Q is placed, to prevent the return of the water; G G is another cistern, into which the water is delivered through the pipe F, which is provided with a valve H, opening outwards; I M represents an over-shot water-wheel, 18 feet in diameter, moving on the axis K L, and communicating its motion to the latches, and other machines used in the manufactory. The water in both the cisterns becomes warmer than the hand, after working a short time; for which reason, the injection-water is forced up by a small pump from a well, supplied from the small steam on which these works are established. A leaden pipe passes from this forcing-pump to the upper or conical part of the chamber E, for the purpose of injecting cold water at the proper time. Neither of these could be represented with convenience in the present section.

The manner in which the steam and cold water are alternately admitted into the chamber E, remains to be explained. Upon the extremity, K, of the axis of the over-shot water-wheel there is fixed a solid wooden wheel, about four feet in diameter; it is also represented in fig. 5, as seen in the front; a, b, c, d, are four cleats, all or any number of which may be fixed on the wheel at a time. Each cleat has its corresponding block, e, f, g, h, on the opposite surface of the wheel. The use of these is to work the engine. Suppose the wheel I M K, with all the revolving apparatus, be turned round by hand, one of the cleats meets in its rotation with a lever, which opens the steam-valve by a bar of communication reaching to the handle of the axis C, fig. 2. The steam consequently falls into the chamber E, and the steam-valve shuts again, as soon as the cleat has passed. Speedily after this, the corresponding block on the other side of the wheel meets another lever, which is similarly attached to the handle of the forcing-pump, and, therefore, throws a jet of cold water into the chamber, and condenses the steam. The preasure of the atmosphere then forces the water from the cistern N O, through the valve Q, towards the chamber E. When the engine has been long out of work, two or three strokes may be necessary to raise the water to the top of the chamber E. As soon as this is the case, the re-entrance of the steam fills the whole body of water, above the valve H, to flow out of the chamber E, by its gravity. E, H, G G, are the water which, when driven upon the over-shot water-wheel, I M, through a sluice; and by that means keeps the work in motion, and replenishes the lower cistern. There is no reservoir for the injection-water, but the requisite quantity is driven up at each stroke.

Hence we see, that in effect this engine is the same as Savery's original engine, except that it is not applied for the immediate purpose of raising water, but gives motion to other apparatus; and it does not force the water by the steam at all. The water merely falls out of the chamber, and consequently never requires steam much stronger than the atmosphere. From the effect of this engine, under circumstances of such advantage, it may fairly be concluded, that the action of steam against water in forcing can never be beneficial, except at places where fuel can be had extremely cheap. It was found, at the first erection of this engine, that the consumption of steam, by contact with the water, was so great, that it could not be worked with advantage. This defect was remedied in the present engine, as in another which was at Norwich, by fixing a small air-valve in the steam-box, which is struck open by the machinery for an instant, immediately before the admission
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It may be presumed, that, according to Mr. Blakely's idea, the air occupied a space above the water, and prevented their coming together. Mr. Kier, however, is disposed to think that the effect does not take place in this manner, but by some mixture and dilatation of the two fluids; because he imagines the mischief from the wet surface of the cylinder would remain the same, when the water descends. To get rid of this air, the steam in the boiler must be let off into a preceding space or the atmosphere, and to rush into the receiver with sufficient force to drive out the air through the same valve at which it entered, and which opens outwards for that purpose; but will shut, to prevent the air entering when the vacuum is made, except for an infant before the steam is admitted, when it is opened by the machinery. The motion of the orlofhot water-wheel is regulated by an apparatus called a governor, invented by Mr. Watt, and which will be described in our account of his engine. It is a pendulous axis, which revolves by communication with the engine, and carries round two pendulous balls; which pendulums move on a joint, fixed to the vertical axis. When the rotation is very quick, the balls fly out, and are applied to draw down a lever, which is connected with the sluice of the upper cistern; the sluice, therefore, is made to fall or rise, according as the velocity of the engine is greater or less. By this disposition, when the wheel moves very speedily from lightness of work, or any other cause, the quantity of water thrown down from the upper cistern is immediately diminished; and, on the contrary, the quantity of water is rendered greater, when the wheels of the movement shall move more as is wanted.

The engine here described has been at work many years, and from the simplicity of its construction has yet exhibited no proofs of wear.

Mr. Kier thinks it a profitable engine to himself, and that it would be serviceable for raising water where coals are cheap. It consumes fix bushels of good coals in twelve hours' work, when in its best state, or seven bushels when at the worst. Under these circumstances it gives ten strokes per minute, each throwing out seven cubic feet of water at an aperture of 20 feet above the water beneath. This quantity, namely, 70 cubic feet per minute, will weigh 4,375 lbs. raised 20 feet high, which being doubled, to reduce it to Defagelius' standard height of 10 feet, will amount to 9,750 lbs. raised 10 feet high; and this divided by 550, the number of pounds in a hoghead in a hoghead, will give a quotient of 16 hogheads raised 10 feet, representing the force of so many men, according to the estimate of that author, who reckons five men equivalent to one horse. The result is not quite half what is performed, with an equal quantity of coals, by the improved engines, with a piston of such size as to be equal to 20 or 25 horses. Philos. Journ. vol. 1.

Several other engines have been erected upon this plan; and where the water which is raised is to be immediately boiled, they are very capital machines, because all the loss of heat is thrown into the water and warms it before entering the boiler, so as to economize the whole: for instance, for the purpose of raising water into the boilers for a fullwork or a brewery, they are very applicable.

We have no accounts of the quantity of water which could be raised by Savery's original engine with a given quantity of fuel; but he tells us in the Miner's Friend, that to lift a three-inch bore of water 60 feet high, would only require a fire-place for the furnace of 20 inches deep, and 14 or 15 wide; the expense of fuel for which, he says, would be inconsiderable, when compared with the advantages to be derived from the use of the engine.

It has been proposed to construct a succession of engines upon Savery's plan in a mine, to raise water by fussion from one to another, and to have all of them worked by one common steam-boiler. For this purpose, the depth of the pit is divided into lifts of about 15 feet, and at each lift is a cistern, to receive the water raised by the different engines. Each engine consists of a vertical fussion-pipe, with the lower end immered in the water of the cistern of the engine below it, and a receiver at the upper end, which communicates with the fussion-pipe through a valve, to prevent the escape of the water from the receiver through the fussion-pipe. There is also a small spout or pipe leading from the side of each receiver into each cistern, which is to receive the water after it is raised into the receiver; and the ends of these spouts are covered with valves, to prevent the water running back into the receivers from the cisterns. All these receivers communicate with a common air-pipe, which leads up to the top close receiver, or air-veil, situated at the top of the pit, which veil is of at least double the capacity of all the receivers and the common pipe together. Immediately above the air-veil is the air-receiver, of equal capacity, and communicating with the air-veil by a pipe, which descends through the top of the cistern, and reaches nearly to the bottom of the air-veil, so that if there is any water in this veil, the end of the communicating pipe will be immered therein.

Suppose the cisterns at the different stages, and also the lower or air-veil, nearly filled with water, and the air-pipe and the small receivers filled with air, the action of the machine will be as follows: the steam is admitted from the boiler into the upper receiver, and expels the air therefrom through a proper cock or valve; when thoroughly filled with heated steam, the communication with the boiler is shut, and an injection of cold water thrown into the receiver; this condenses the steam, and forms a vacuum in the upper receiver: this being the case, the air contained in the air-pipe and receiver, by its elastic pressure upon the surface of the water contained in the great air-veil, causes the water to mount through the pipe of communication into the upper or steam-receiver. This causes the air in the pipes and receivers to occupy a greater space than it did before, and being thus rarefied, it no longer balances the pressure of the atmosphere upon the surface of the water contained in each cistern; it therefore forces the water up the respective fusion-pipes into the small receivers, and will fill each of them one half with water, and then the air contained in the remaining half of each receiver, and in the great air-veil above, comes to its equilibrium. The steam is now admitted a second time into the steam-receiver, and flashing upon the surface of the water therein, allows it to descend by its gravity into the air-veil beneath, from which it expels the air, and by the communication of the air-pipe it enters into the upper part of each of the small receivers, and entering the boiler, or to a boiler, for instance, for the purpose of raising water into the boilers for a fullwork or a brewery, they are very applicable.

We have no accounts of the quantity of water which could be raised by Savery's original engine with a given quantity of fuel; but he tells us in the Miner's Friend, that to lift a three-inch bore of water 60 feet high, would only require a fire-place for the furnace of 20 inches deep, and 14 or 15 wide; the expense of fuel for which, he says, would be inconsiderable, when compared with the advantages to be derived from the use of the engine.
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of the steam to obtain a vacuum; for instance, it is not necessary for an engine of this kind to have steam in the boiler of much greater pressure than the atmosphere; suppose it is equal to raising water two feet, by our second table this will be at a temperature of 215°. Now, according to our first table, in order to obtain such a degree of rarefaction of preasure within the receiver as to lift a column of 30 feet of water, the temperature must be cooled down to 120°; therefore, at every stroke of the engine a change of temperature must be made equal to 95°, viz. between 120° and 215°. On this account, such an engine would require a great quantity of condensing water, and it is probable that it would be better to make the water, which the engine raises, pass through the receiver, on Savery's plan, or at least such a portion of it, as will keep the temperature of the water in the receiver sufficiently low to obtain the condensation which we have above mentioned.

In employing air in this manner to transmit the force of the steam into other vessels, there is always the loss from the elasticity or compressibility of the air, which, in the case above stated, will be equal to one-half; because, when a sufficient rarefaction is made within the steam-receiver to cause the atmosphere to press upon it equal to 13 lbs. upon the square inch, or to suck up water 30 feet, the air contained in the air-vessel and pipes will expand itself so as to balance one-half of that pressure; and, therefore, the degree of rarefaction within the small receivers will be only sufficient to raise the water 15 feet instead of 30. On the other hand, when the steam is admitted into the receiver, it must be in sufficient quantity to restore the air to its original density, before it will balance the pressure of the atmosphere, and allow the water to flow out of the receivers into their cisterns.

**Fig. 5.** represents a similar contrivance to the above, but it is for forcing. It was suggested by Mr. Kier, in 1783. A is a boiler, and B a steam-vessel; this last communicates with the vessels M, L, K, T, each of which, except the lower one, consists of two vessels; first, an external cistern, open at the top; and secondly, an interior receiver, immered in the water of the cistern, and closed on all sides, except where it communicates with B, by the branches of the receiver, the pipe F G H descending from B, and where the pipes P, O, N, I enter the upper part of each, and extend within or nearly to the bottom, and also where there is a valve at the bottom opening upwards. If steam be let pass from A to B, the air will be driven from B through the pipes F, and press upon the surface of the water in the lower receiver T, and drive the same up the pipes into the vessel or cistern K, but not into the receiver K, because the pressure of the air within that receiver keeps the valve in the bottom of the receiver shut. The next step of the operation consists in closing the cock C, and opening D, out of which a portion of steam will be driven, by the reaction of the water forcing itself through the valve in the bottom of the receiver T, from its natural tendency to rise to the same level as the surface of the water in the pit or well; and on the same account the water will enter into the receiver K, from the cistern in which it is immersed; the cock D is then to be closed, and C opened; in consequence of which, the contents of the receiver, T, will be forced up into the cistern K, by the steam, as before, and the receiver, K, will discharge its contents through the pipe, N, into the cistern L.

The steam being again shut off at C, and the cock D being opened, as before, the receivers, T, K, and L, will fill in the same manner, by the water from the exterior cistern entering through the valves in their bottoms, and a larger portion of steam will issue from D. A third repetition of the process will drive the contents of these three receivers a step higher; and a fourth repetition will cause the contents of the upper receiver, M, to flow out at P, after which, every alternation of the work with the cocks C, D, will throw out the same quantity from P.

The vessel B must necessarily contain a quantity of air capable of occupying the whole interior space contained in the closed receiver, with an allowance for the loss of bulk in condensation, under the pressure of a column of water equal to one of the lifts; and the quantity of steam to be discharged at each stroke, must occupy a space equal to that of all the water moved at each stroke; and much, in all cases, be considerably stronger than two atmospheres, in proportion to the heights of the lifts.

**Other Proposals for the Improvement of Savery's Engine.**—In the Memoirs of the Philosophical Society of Lanthorn, M. François has described a steam-engine on Savery's plan, which he proposes to be used for draining fens or marshes, and has added machinery to open and shut the cocks; it has otherwise nothing remarkable. See Repertory of Arts, first series, vol. iv.

In the American Philosophical Transactions there is a description of a steam-engine, on Savery's principle, by Mr. Nancarrow, which is applied to raise water for turning a water-wheel. In this engine, the receiver, into which the steam is admitted, is a tall cylindrical pipe, with only a slight enlargement at the top to form the receiver; and the water is only raised by the pressure of the atmosphere; and to prevent the water being changed and continuing cold, so as to condense the steam, it is not suffered to run off immediately from the receiver, as in Mr. Kier's engine, but nearly at the bottom of the tall cylindrical pipe it is joined to a box, as shewn by the dotted lines in the figure of his engine, and from this box a second vertical pipe, or force-pipe, ascends to the reservoir which contains the water; the valve to prevent the return of the water is placed at the lower end of this second pipe.

By this means, the portion of water which comes in contact with the steam rises and falls in the receiver, and alternately draws and forces other water through the box below, from the suction-pipe, and into the force-pipe and reservoir. But this water, when it becomes heated, acts like a floating piston on the surface of the cold water to prevent the contact of the steam. Mr. Nancarrow proposed to employ a separate condenser and air-pump to produce the vacuum, instead of making an injection into the receiver; but this would be attended with no advantage; and we have before stated the objections to the water growing heated any more than superficially.

At the same time we think that a very good and simple engine might be made, if this form of the apparatus, in which the water shall never be changed, was applied to forcing by the pressure of the steam only, on the marquis of Worceter's plan, and not to attempt condensation, which is impossible to effect perfectly, when the water has become very hot; but instead thereof, when the steam has exerted its force, to open a cock, and let off the steam into the open air. An engine of this kind, which only requires the additional receiver, is described in Leopold's Theatrum Machinarum Hydrostaticarum, vol. ii. 1724.

The last improvement which we have noticed in Savery's engine, is by Mr. James Boaz, of Glasgow, who took out a patent in 1805, for several different forms of the engine. In all these the receiver is made cylindrical, and a piston is applied to float upon the surface of the water, upon Papin's plan; and in the same manner as Nancarrow's engine, he
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be proposes to employ such an arrangement of the force-pipes, and of a second small receiver, that the water which comes in contact with the steam shall not be changed, but shall always remain the same; a method which precludes the use of the vacuum by condensation. The specification of this patent is published in the Repertory of Arts, vol. viii.

Newcomen’s, or the Atmospheric Steam-Engine.—This engine is named after its inventor, Mr. Thomas Newcomen, an ironmonger of Dartmouth, in Devonshire. He appears to have been a person of ingenuity, and of some reading; and was acquainted with the famous philosopher Dr. Hooke. Newcomen was in the habit of visiting the mines of tin and copper in Cornwall, where captain Savery was well known, from his attempts to introduce his engine for the draining of mines, which, at that period, were nearly all of them at a stand, for want of some more powerful and cheap machines than hand-pumps or horse-machines.

The captain was not successful in his attempts, principally because he employed the direct action of the steam upon the water, which either confined him to the height of 25 feet, or compelled him to employ steam of a great elastic force; in which case it became an indispensible condition, that the boiler and vessels should be very strong, as well as that a large quantity of fuel should be consumed, to produce steam sufficiently dense. It is probable that these inconveniences may have early directed the thoughts of other ingenious men to the application of a piston; but the difficulties of the undertaking seem to have retarded this pursuit for a considerable time.

The first steam-engine with a piston, made by Papin in 1707, which we have described, was not at all calculated to remove the difficulties; and it is to Newcomen, and his associate Cawley, that we are indebted for the application of a piston with machinery, by which the indirect action of steam a little stronger than the atmosphere, or rather the direct action of the atmosphere upon a piston, is made to act with safety and effect against the most severe preffures. It appears that they had brought their atmospheric engine, about the year 1713, to a degree of perfection little inferior to that which are to be seen at present.

Principle of the Atmospheric Engine.—To have an idea of its principles and mode of action, suppose a very large syringe or cylinder to be placed upright, and a piston or plug inserted at the upper end, the usual aperture being supposed to be at the lower extremity. If this last aperture be opened, the piston will descend by its own weight, neglecting the effect of friction at its circumference. But let it be imagined that the piston is supported by a counter-weight applied at the opposite extremity, a lever, or by any other means: in this case the piston will not descend unless more weight is added to it.

Among the various ways of applying such a weight, there is one which consists in exhausting the air from the internal part of the cylinder, beneath the piston; and if this is done, it is evident that the whole preffure of the atmosphere, amounting to about 14.4 pounds on every square inch, will become active upon the upper surface of the piston. This method of gaining a great force was invented by the famous Otto Guericke; see his Experimenta Magdeburgica, 1672.

If the vacuum was to be produced by means of an air-pump on Guericke’s plan, it must be allowed that the labour of effecting it would be at least equal to that of any work which could be performed by the subsequent descent of the piston; we must therefore seek some other means of producing such a vacuum. We have seen that in Savery’s engine the operation of steam is two-fold, namely, by the direct preffure from its elasticity, and by the indirect influence of its condensation, which affords a vacuum. This last is the only principle employed in Newcomen’s engine.

In order to produce the vacuum at pleasure in the interior capacity of the syringe or cylinder, of which we have been speaking, it becomes requisite that several apertures should be formed at the bottom of the cylinder; one to communicate steam from a boiler, and provided with a cock to cut off or open the communication at pleasure; another to admit at pleasure a jet of cold water, to condense the steam during the interval in which the communication from the boiler is cut off; a third, provided with a drain-pipe, called the eduction-pipe, to carry off the condensed steam and injection-water; and lastly, a small lateral aperture, with a valve, to allow the escape of the air, or permanently elastic fluid, which will not condense by the application of cold water, or run off through the eduction-pipe: this last is called the snuffing-clack.

By these provisions the operation of the cylinder is made to take place in the following manner. The piston-rod is attached by a chain to the end of a long lever, at the opposite end of which are suspended the rods of the pumps which are to draw the water; and the weight of these rods exceeds the weight of the piston so much, as to draw the piston up to the top of the cylinder. In this state, the steam-cock is opened, and steam issues from the boiler; but being less than half the weight of common air, it rises to the top of the cylinder, and expels the air through the snuffing-valve and eduction-pipe, of which the lower extremity is covered with a flap-valve, in a trough of water. When the noise of its escape through these valves is heard, the steam-cock is shut, and the injection-pipe being opened, throws up a stream of cold water in a jet within the cylinder, and strikes against the bottom of the piston: the steam becomes immediately condensed, and the preffure of the atmosphere forces the piston down into the vacuum. Upon its progress downwards, the injection-pipe is closed; and when it has arrived nearly at the bottom of the cylinder, the steam-cock is again opened. The elastic steam fills the small space between the cylinder and the bottom, and its preffure on the under surface of the piston affords it to rise, and also affords the eduction-water which remains in the bottom of the cylinder to pass off through its pipe: the steam also drives the air, or other elastic fluid which will not condense, through the snuffing-valve. In this state, therefore, the steam is somewhat stronger than the atmosphere, and rather more than counterpoises its action on the upper surface of the piston; in consequence, the piston itself rises by the action of the counter-weight, or pump-rods, at the opposite end of the lever, and regains its original position at the top of the cylinder.

A second repetition of the process, namely, of shutting off the steam, and injecting cold water, causes the piston again to descend, and in this manner the alternations may be continued without limit.

It is to be understood, that the opening and shutting of the steam and injection-cocks are performed by apparatus fixed to the working lever, in such a manner as to strike the levers of those cocks at the precise instant of time when their effects are required to be produced. The attendant has no other office to perform than that of keeping up the fire. To apply this power to the purpose of raising water for draining a mine, suppoce a common sucking-pump placed in the pit to lift the water fifty yards high. If the pump is 7½ inches bore, the column of water which must be raised when the rod or bucket of the pump is drawn up, will weigh 3060 lbs.; a chain being attached to the upper end of the rod of the pump, and suspended from the extremity of the
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long lever or working beam; and at the opposite extremity of the same beam another must be attached, to suspend the piston of the steam cylinder, which we have just described.

To give this piston a sufficient power of descent to make it draw up the water in the pump at the opposite end of the beam with celerity, the piston must be 22 inches in diameter; the area or surface of the piston will then be 350 square inches, $32 \times 22 = 464 \times 7854 = 350$. In this case, if each square inch is pressed with a weight of eight pounds, it will balance the weight of the water in the pumps within 30 pounds; for 350 $\times 8 = 2800$, instead of 3500; but the pressure on each square inch will be considerably more than eight pounds; for, provided the vacuum was perfect within the cylinder, the pressure of the atmosphere would be 142 pounds; but the condensation of the steam in the cylinder is so far incomplete, that it leaves steam or vapour within the cylinder of some density. If the steam is cooled by the injection down to 140°, it will be seen by our first table, fourth column, that it will leave the cylinder mixed with a vapour of an elastic force equal to 23 oz. per square inch; which force acting beneath the piston, will deflect from the pressure of the atmosphere, and reduce the next pressure on the piston, to 11 lbs. 13 oz. per square inch, as shown by the last column. The excess of pressure beyond what is necessary to balance the weight of water is 3 lbs. per square inch, amounting, on the whole surface of the piston, to (3 x 380 =) 1140 lbs. nearly, a weight which is allowed to overcome the counter-weight which is to draw the piston up again, and the friction of the piston and pump-buckets, and make the engine move with a sufficient velocity, which will be more or less according to the state of the engine. But taking this velocity at 16 strokes per minute of six feet length each = 96 feet motion per minute, the pump of 7½ inches diameter will raise 192 gallons per minute, or 185 hogheads 15 gallons per hour. An engine of these dimensions is but a small one, yet it serves to show the superiority of Newcomen's over Savery's engine, in principle. Savery's was an engine which really raised water by the force of steam; but Newcomen's raises water entirely by the pressure of the atmosphere, steam being employed merely as the most expeditious method of condensing the air into which the atmospheric pressure may impel the first mover of his machine. The elasticity of the steam is not the first mover. In the example of the engine we have just given to drain the same mine on Savery's plan, he must have employed steam of a pressure of 55 pounds per inch, and of a temperature of 325 degrees, to raise a column of water to a height of 125 feet; the condensation of this steam would be so great on coming in contact with water of only 50 degrees, that he would have found it scarcely practicable to have thrown up any considerable quantity.

We see also the great superiority of this new machine. There is no need of steam of great and dangerous elasticity, as it operates by means of very moderate heats, and consequently with much smaller quantities of fuel; and there are no other bounds to the power of this machine, than the strength of the materials of which it is composed. How deep forever a mine may be, a cylinder may be employed of such dimensions, that the pressure of the air on its piston may exceed in any degree the weight of the column of water to be raised; and lastly, this form of the machine renders it applicable to almost every mechanical purpose, because a skilful mechanic can readily find a method of converting the reciprocating motion of the working beam into a motion of any kind which may suit its purpose. Savery's engine could not admit of such an immediate application, and was restricted to raising of water.

Invention of Newcomen's Engine.—Referring the invention of this engine, it was less a matter of original discovery, than of a combination of the inventions of others, viz. of Savery's invention of the means of producing a vacuum by the condensation of steam, with Otto Guericke's exhausted cylinder.

Savery made claim to the invention, and in consequence of the claim he made to the mode of condensation, as being a part of his patent, he was admitted by Newcomen and Cawley to an association with them in the patent which was granted in 1705, but it does not appear that they made any perfect engine until 1711.

Defenestrians, in his account of the invention, makes no mention of captain Savery being associated; but says "that Thomas Newcomen, ironmonger, and John Cawley, glazier, of Dartmouth, in the county of Southampton (Baptists), made several experiments in private about the year 1710, and in the latter end of the year 1711 made proposals to drain the water of a colliery at Leigh, in Warwickshire, where the propietors employed 500 horses at an expense of 4000 a year; but their invention not meeting with the reception they expected, in March following, through the acquaintance of Mr. Potter of Bromsgrove, in Worcestershire, they bargained to draw water for Mr. Back of Wolverhampton; where, after a great many laborious attempts, they did make the engine work: but not being either philosophers to understand the reason, or mathematicians enough to calculate the powers and proportion of the parts, they very stalkly, by accident, found what they sought for. "They were at a loss about the pumps, but being near Birmingham, and having the assistance of so many admirable and ingenious workmen, they soon came to the method of making the pump-valves, clacks, and buckets, whereas they had but an imperfect notion of them before. One thing is very remarkable; as at first were working, they were surprized to see the engine go several strokes, and very quick together, when, after a search, they found a hole in the piston, which let the cold water in to cool the steam in the cylinder, whereas before they had always done it as the outside. They used before to work with a buoy in the cylinder, inclosed in a pipe, which buoy rose, when the steam was strong and opened the injection, and made a stroke; but they were not capable of giving six, eight, or ten strokes in a minute, till a boy, Humphrey Petter, who attended the engine, added (what he called soggess) a catch, that the beam always opened, and then it would go 15 or 16 strokes a minute. But this being perplexed with catches and frings, Mr. Henry Beighton, in an engine he had built at Newcastle-upon-Tyne, in 1718, took them all away, but the beam itself, and supplied them in a much better manner." Since that time no very material alterations have been made in this species of engine, except the addition of the crank to make it turn mills.

The French authors have claimed this engine also as the invention of their countryman Papin, but without any reason: Papin had gained a knowledge of the expansive force of steam in his digester, and he invented the mode of working the pistons and cylinders by a vacuum and the pressure of the atmosphere; but he was not the first inventor of either of these, Otto Guericke and the marquis of Worcechester having discovered the same things long before him; and further, he had no pretensions to claim Savery's discovery of the condensation of steam, upon which the engine of Newcomen depends.

Papin's Air Cylinder Engine.—Papin's invention of the cylinders
The consequence will be, that by the continual suction of the air-pumps a vacuum will be found under one piston, and the pressure of the atmosphere will act to press it down in its cylinder; and by the rope which is attached to it and wound round the axle of the wheel, its descent will cause the axle and wheel to turn round and draw up the cord which pulls over the wheel at one side, so as to raise up one bucket in the mine and lower down the other; but, during the descent of this piston, the other piston is freely at liberty to be drawn up in its cylinder, because the cock admits the atmospheric air into the same. When the piston under which the vacuum has been made is pressed down to the bottom of its cylinder, the other piston will be drawn up to the top of its cylinder, by its rope winding upon the axle. In this state the cock is turned the other way, and will then draw off the air from the cylinder in which the piston is at the top, and admit fresh air into the cylinder in which the piston is at the bottom. This will cause the axle and wheel to turn round in an opposite direction to what it did before, and draw up the opposite bucket from the mine.

In this way a continual reciprocation of the motion of the axle is kept up, and the power of the water-wheel is transmitted simply by the conveyance-pipe to any required distance, where, by using a larger or smaller cylinder, it may be made to act with any required force. The inventor proposed this method to be used to convey the power of the water-wheels in the Seine to work pumps at Vertaults, instead of using the cumbersome machinery employed at Massy for conveying the motion; and it is rather surprising that so simple and advantageous a method should have remained so long neglected and unknown, that even now, when its effects are publicly exhibited, the means are not known. The only improvement upon the method of Papin, which it is necessary to put in practice, is to have a receiver or air-chamber near the cylinders, to be kept exhausted by the pumps; and this being of sufficient capacity the air will rush into it, and be taken away from beneath the piston the instant the cock is opened; whereas, without it, it would be drawn off more slowly by the pumps. If the conveyance-pipe is made of large dimensions, it will effect the same end most completely.

**Description of the Atmospheric Engine.**—Our readers being now acquainted with the principle of Newcomen’s engine, we shall proceed to describe it in the state to which it was brought by Mr. Beighton, and which for more than half a century was the standard engine for raising water from mines. See the perspective view in Plate II., fig. 1., which represents the engine complete, the front wall of the house being supposed to be removed to shew the interior.

A, the fire-place under the boiler for raising the steam, and the ash-hole below it.

B, the boiler, made of iron plates; it is filled with water about three feet above the bottom.

C, the steam-pipe, through which the steam passes from the boiler into the receiver.

D, the receiver, a close iron vessel or box, in which is the regulator or steam-cock, which opens and closes the hole of communication with the cylinder at each stroke.

E is the communication-pipe, between the receiver and the cylinder; it rises five or six inches up in the interior of the cylinder above the bottom, to prevent the injected water from descending into the receiver.

F, the cylinder of cast-iron, about ten feet long, bored smooth in the inside; it has a broad flange in the middle, on the outside, by which it is supported when hung between the cylinder-beams, which extend across the house, and are let into the side-walk.
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G, the piston, made to fit the cylinder exactly, but with liberty to slide up and down; it has a flange rising four or five inches upon its upper surface, between which and the side of the cylinder a quantity of junk or oakum is stuffed, and kept down by weights, to prevent the entrance of air or water, and the escape of steam.

H, the chain and piston-shank, by which it is connected to the working beam by an arc of a circle.

I, I, the working beam, or lever, working on its centre, in the manner of a scale-beam; it is made of two or more large logs of timber, bent together at each end, and kept at the distance of eight or nine inches from each other in the middle by the gudgeon or centre, as represented in the plate.

The arch-heads I, I, at the ends of the beam, are for giving a perpendicular direction to the chains of the piston and pump-rods, which are fastened at the opposite ends.

K, the pump-rod, which works in the great fucking-pump L, and draws the water from the bottom of the mine to the surface.

M, a cistern, into which the water drawn out of the pit is conducted by a trough, so as to keep it always full, and the superfluous water is carried off by another trough.

N, the jack-head pump, which is a smaller fucking-pump, wrought by a small lever or working beam, by means of a chain connected to the great beam or lever near the arch g, at the inner end; and the rod of the pump N is fastened by a chain at the outer end. This pump commonly stands near the entrance of the house, and raises a column of water up to the cistern O, into which it is conducted by a trough.

O, the jack-head cistern, for supplying the injection; it is always kept full by the pump N, and is fixed so high above the cylinder bottom, as to give the jet of injection a sufficient velocity into the cylinder when the cock is opened. This cistern has a waiste-pipe on the opposite side for conveying away the superfluous water.

P, the injection-pipe, of two or three inches diameter, which descends from the cistern, O, to the injection-cock r, after passing which it turns up in a curve at the lower end, and enters the cylinder bottom. It has a thin plate of iron screwed upon the end d, which is within the cylinder, with three or four ajutage holes in it, to cause the jet of cold water from the jack-head cistern to fly up in as many streams against the under surface of the piston, and condense the steam contained in the cylinder each stroke, when the injection-cock is open.

Q, a valve upon the upper end of the injection-pipe, which is shut, to prevent waife of water by leakage when the engine stands still; but before the engine is set to work, this valve must be lifted up, and kept open by a string.

R, a small pipe, which branches off from the injection-pipe, and has a cock to supply the piston with a little water to keep it air-tight.

S, the working plug, suspended by a chain to the small arch g, of the working beam. It is usually a heavy piece of timber, with a slit vertically down its middle, and holes bored horizontally through it to receive pins, for the purpose of opening and shutting the injection and steam-cocks, as it ascends and descends by the motion of the working beam.

b, the handle of the steam-cock or regulator. It is fixed to the regulator by a spindle, which comes up through the top of the receiver. The regulator itself is a feotorial plate of bras, shaped like a fan, which is moved horizontally by the handle b, and opens or shuts the communication at the lower end of the pipe E, within the receiver. It is represented separately in the plate by fig. 2.

i, the spanner, which is a long rod or bar of iron, for communicating motion to the handle of the regulator, to which it is fixed by means of a flit in the latter, and some pins put through to fasten it.

k, the vibrating lever, called the tumbling-bob, or the Y, having the weight k at one end, and the two forked legs at the other end, like the letter A turned. It is fixed to an horizontal axis, moveable about its centre pins, or pivots, m, m, and is put in motion by means of the two shanks o, o, fixed to the same axis, which are alternately raised and depressed by means of two pins in the working plug, and the bob or weight at the top of the Y is thrown backwards and forwards; one pin on the outside, depring the shank o, throws the loaded end, k, of the Y from the cylinder into the position represented in the plate, and causes the leg, b, of the fork of the Y to strike against the end of the spanner, which forcing back the handle of the regulator or steam-cock opens the communication, and permits the steam to fly into the cylinder. The piston immediately rises by the weight of the pump-rod, on the admission of the steam: the motion of the working beam, I, also raises the working plug s and another pin, which goes through the flit, raises the shank, p, of the axis, which throws the end, k, of the Y towards the cylinder, and the leg of the fork, striking the end of the spanner, forces it forwards, and shuts the regulator or steam-cock.

q, r is the lever for opening and shutting the injection-cock, called the F. It has a rack or toothed feotor fixed upon its axis, which takes the teeth of a pinion, fixed on the top of the plug or key of the injection-cock.

When the working plug has ascended nearly to its greatest height, and shut the regulator, as above described, a pin catches the end, q, of the F, and raises it up, which opens the injection-cock, and admits a jet of cold water to fly into the cylinder, and condensing the steam, makes a vacuum within. Then the preufure of the atmosphere, forcing down the piston into the cylinder, causes the plug-frame to descend, and another pin fixed in it catches the end of the lever, q, in its descent, and by pressing it down shuts the injection-cock; at the same time the regulator is opened to admit steam, and so on alternately; that when the regulator is shut, the injection-cock shall be open, and when the former is open, the latter shall be shut.

R, the eutufion-pipe, to convey away the water which is injected into the cylinder at each stroke; its upper end is even with the cylinder bottom, and its lower end has a lid or cover, moveable on a hinge, which serves as a valve to let out the injected water, and shuts clofe each stroke of the engine, to prevent the water being forced up again when the vacuum is made.

S, the hot-well, which is a small cistern made of planks, to receive all the waife water from the cylinder, and keep it in reserve for feeding the boiler, to supply the waife occasioned by the continual evaporation of the steam.

T, the feeding-pipe, to supply the boiler with water from the hot-well. It has a cock to let in a large or small quantity of water, as occasion requires, to make up for what is evaporated; it goes nearly down to the boiler bottom, so that the lower end is always immersed in water.

U, two gauge-cocks, in the upper ends of two pipes which descend into the boiler; one is deeper than the other; their use is to try when a proper quantity of water is in the boiler, for upon opening the cocks, if one gives steam and the other water, it is right, because the intended level of the water in the boiler is between the ends of the two. If they both give water there is too much.

W is the man-hole; it is a plate which is screwed over a hole
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a hole on the side of the boiler, to allow a passage into it for the convenience of cleaning or repairing.

X, the steam-clack or puppet-valve, which is a brass valve, on the top of the pipe opening into the boiler, to let off the steam when it is too strong. It is loaded with lead at the rate of one pound to an inch square; and when the steam is nearly strong enough to keep it open, it will do for the working of the engine.

Y, the safety-valve, by which, at every ascent of the piston, the steam discharged from the cylinder which was admitted with the injection, and would otherwise obstruct the due operation of the engine.

Z, the cylinder beams, which are strong girders going through the house, for supporting or rather keeping down the cylinder.

G, the cylinder cup of lead surrounding the top of the cylinder, to prevent the water upon the piston from floating over when it rises too high.

H, the waste-pipe, which conducts the superfluous water from the top of the cylinder to the hot-well.

I, iron bars, called the catch-pins, fixed horizontally through each arch-head to strike the floor, and prevent the beam descending too low, in case the chains at either end should break, or if the engine makes too long a stroke.

J, two strong wooden springs, to weaken the blow given by the catch-pins, when the stroke is too long.

K, two friction-wheels or fectors, on which the gudgeons, or centres of the great beam, are supported; they are the third and fourth part of a circle, and move a little each way as the beam vibrates.

Their use is to diminish the friction of the axis, which being necessarily very large for so heavy a lever, would otherwise be very great.

Operation of the Atmospheric Engine.—When this engine is to be set to work, the boiler must be filled about two or three feet deep with water, and a large fire made under it; and when the steam is heated to be of sufficient strength to exert a pressure of about one pound beneath each quarter inch of the safety-valve, it will lift up the valve and escape. The water in the boiler being superheated to be in a strong state of ebullition, and the steam issuing by the safety-valve, we will consider the machine in a state of rest, having both the steam-cock and injection-cock shut. The refilling position or attitude of the machine is such as appears in the drawing, the pump-rods, K, preponderating by their weight, and the great piston being drawn to the top of the cylinder.

The man who attends the engine depresses the handle p, so as to throw the thumbling-bob into the position of the figure; and the leg of the fork thrusting back the spanner is, opens the regulators on steam-cock, when the steam from the boiler immediately rushes in, and flying all over the cylinder, will mix with the air: much will be condensed by the cold surface of the cylinder and piston, and the water produced from it will trickle down the sides, and run off at the aduction-pipe, R, as soon as any quantity is accumulated. This condensation and waste of steam will continue, till the whole cylinder and piston are made as hot as boiling water.

When this happens, the steam will begin to open the safety-valve s, and issue through the pipe; at first slowly and very cloudy, being mixed with much air, the cloudy appearance of steam being always owing to its mixture with common air. The blast at s will grow stronger by degrees, and more transparent, having already carried off the greatest part of the common air which filled the cylinder. We supposed, at first, that the water was boiling briskly, so that the steam was issuing by the safety-valve, which is in the top of the boiler. The opening of the steam-cock puts an end to this at once, because the cold cylinder draws off the steam from the boiler with astonishing rapidity, until it becomes heated so as not to condense.

When the manager of the engine perceives that not only the blast at the safet-valve is strong and steady, but that the boiler is fully supplied with steam of a proper strength, which appears by the renewal of the discharge at the safety-valve, the engine is ready for starting. He now lifts up the handle o or q, till the thumbling-bob, Y, falls over the perpendicular towards the cylinder, and its leg striking the cross-pin of the spanner, i, draws it forwards, and shuts the steam-regulator; at the same instant he lifts up the handle, q, of the F, which opens the injection-cock. The preasure of the column of water in the injection-pipe, P, immediately forces some water through the spout d, by the jets.

The cold water coming in contact with some of the pure vapour, which now fills the cylinder, condenses it, and thus makes a partial void into which the more distant steam immediately expands; and by this very expansion its capacity for heat is increased; or, in other words, as it grows cold, it absoals the heat more powerfully from the steam situated immediately beyond it.

In this expansion and refrigeration the steam is itself partly condensed or converted into water, and leaves a void, into which the circumjacent steam immediately expands, and produces the same effect on the steam beyond it: and thus it happens, that the abstraction of a small quantity of heat from an inconsiderable mass of steam produces a condensation throughout a cylinder which is very extensive.

What remains in the cylinder no longer balances the atmospheric preasure on the surface of the water in the injection-cistern, and, therefore, the water spouts rapidly through the holes d, by the joint action of the column P, and the unbalanced preasure of the atmosphere; at the same time the safety-valve s, and the eduction-valve R, are shut by the external preasure of the atmosphere, and prevent the entrance of air or water into the cylinder. The velocity of the injection-water must therefore rapidly increase, and the jets dash against the bottom of the piston, and be scattered through the whole capacity of the cylinder. In a very short space of time therefrom, the condensation of the steam becomes universal, and the elasticity of what remains is very small. The whole preasure of the atmosphere, therefore, being exerted on the upper surface of the piston, while there is hardly any on its under side, if the load on the outer end of the working-beam is inferior to this preasure, it must yield to it. The piston G must descend, and the pump-piston K must ascend, bringing along with it the water of the mine; but the motion does not begin at the instant the injection is made.

The piston was kept at top by the preponderancy of the outer end of the working-beam and the load of water in the pumps, and it must remain there, till the difference between the elasticity of the steam below it, and the preasure of the atmosphere, exceed this preponderancy. There must, therefore, be a small space of time between the beginning of the condensation and the beginning of the motion: this is very small, not exceeding the third or fourth part of a second; but it may be very distinctly observed by an attentive spectator, who may perceive, that the instant the injection-cock is opened, if the cylinder has the slightest yielding in its fulness, it will heave upwards a little by the preasure of the air on the bottom. Its own weight is not at all
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equal to this pressure; and instead of its being necessary to support it by a strong floor, it must be kept down by large beams, loaded at the end with heavy weights. This heating of the cylinders causes the instantaneous commencement of the condensation; and it is not till after this has passed, that the piston is seen to start, and begins to descend.

The motion must continue till the great piston reaches the bottom of the cylinder, because it is not like the motion which would take place in a cylinder of air rarified to the fame degree. In this latter case, the impelling force would be continually diminished, because the capacity of the cylinder diminishing by the descent of the piston, the air in it would continually become more dense and elastic, until the piston would float at a certain height, where the elasticity of the included air, together with the load at K, would balance the atmospheric pressure on the piston. But when the contents of the cylinder are pure vapour, and the continued stream of injected cold water keeps down its temperature to the fame pitch as at the beginning, the elasticity of the remaining steam can never increase by the descent of the piston, nor exceed what corresponds to the temperature, according to our table. The impelling or accelerating force, therefore, remains the same; and the descent of the piston will be accelerated almost uniformly, unless there is an increase of resistance, arising from the nature of the work performed by the other end of the beam. And it may be frequently observed in a good steam-engine, where every part is air-tight, that if the cylinder has been completely purged of common air before the steam-cock is shut, and if none has entered since, the piston will descend to the very bottom of the cylinder. It sometimes happens, by the great pump drawing air, or some part of the communication-chains giving way, that the piston descends with such violence as to beat out the bottom of the cylinder with the blow, and it is to prevent this accident that the catch-pins are applied at the end of the beam.

When the manager feeds the piston as low as he thinks proper, he shuts the injection-cock, by depressing the lever g; and at the same time he opens the regulator, by forcing down the handle s, which overfrets the tumbling-bob, and its leg catching the crook-pin of the spanner, t, opens the regulator.

The steam has been accumulating above the water in the boiler during the whole time of the piston's descent. The moment, therefore, that the steam-cock is opened, the steam, having an elasticity of rather more than one pound per square inch greater than that of the air, rushes into the cylinder, where it immediately blows open the snuffing-valves, and aslips the water which had come in by the former injection, and which arose from the condensed steam, to descend by its own weight through the eduction-pipe S, and open the valve to run out into the hot-well R.

This water is nearly boiling-hot; or at least its surface; for while lying in the bottom of the cylinder, it will condense steam till it acquires this temperature, and therefore cannot run down till it will condense no more. There is a cause of some waste of steam at its first admission, in order to heat the inside of the cylinder, and the injected water, to the boiling temperature; but the space being small, and the whole being already very warm, it is very soon done; and when things are properly constructed, little more is wasted than was necessary for the eduction-pipe is made of large dimensions, and receives some of the injection-water even during the descent of the piston, and this portion will be removed out of the way of the steam.

The first effect of the entering steam is of great service; it drives out of the cylinder the vapour which it finds there. This is seldom pure steam, or watery vapour, because all water contains a quantity of air in a state of chemical union; but the union is only feeble, and a boiling heat is sufficient for disengaging the air. If the latter part of the piston descends, and the steam is subjected to increased pressure, the air is freed, or is reduced to the state of a gas, and is driven off. The steam may also be disengaged by simply removing the external pressure of the atmosphere. This is clearly seen when we expose a glafs of water in an exhausted receiver. Therefore the small space below the piston contains watery vapour, mixed with all the air which had been disengaged from the water in the boiler by ebullition, and all that was separated from the injection-water by the diminution of external pressure, in addition to any which may enter by leakage.

Let us now consider the state of the piston, when letting out on its return; as it is evident that it will start, or begin to rise by the counter-weight, the moment the steam-cock is opened; for at that instant the excess of atmospheric pressure, by which it was kept down in opposition to the preponderancy of the outer end of the beam, is diminished. At the first instant of the return of the pump-rods, they draw up the piston with great violence, all the weight of the water in the pumps acting in addition to the counter-weight; but the falling of the lower valves in the pumps, after an inch or two of motion, arrests the further descent of the water, and bears the weight of the column of water; and after this the piston will rise gradually by the action of the counter-weight.

The action of the counter-weight is very different in the two motions of the engine; for while the engine is making a working stroke, it is lifting not only the column of water in the pump, but the absolute weight of the bucket-rods also; and while the pump-rods are descending, there is a diminution of the counter-weight, by the whole weight of the water in the pump, by the immersion of the rod in water. The wooden rods which are generally used being soaked in water, and joined by iron straps, are heavier, and but a little heavier, than water, and they are generally about one-third of the bulk of the water in the pumps.

By this counter-weight the piston is drawn upwards; and it would even rise, although the steam which is admitted was not quite so elastic as common air.

Suppose the mercury in the barometer to stand at 30 inches, and that the preponderancy at the outer end of the beam was equal to 4th of the pressure of the air on the piston, the piston would not rise if the elasticity of the steam was equal to 100; that is, to 26½ inches nearly; but if the steam was just equal to this quantity, the piston would rise as fast as the steam of that density could be supplied to the cylinder through the steam-pipe; and on this supposition, the velocity of the ascent would depend on the velocity of that supply. But this is not the case in practice, because the steam must be stronger than the air, in order to blow out and discharge the air; it will therefore enter the cylinder without any effort on the piston to draw or suck it in. At the same time, the counter-weight must not be so great as to draw up the piston with that force which will cause a suction within the cylinder greater than the steam-pipe can supply, or it would diminish the preasure of the steam within the cylinder lower than the atmosphere, and prevent it from fertilizing or blowing out the air.

In filling the cylinder with steam, it will require a much more copious supply of steam than merely to fill up the space left by the ascent of the piston; for as the descent of the piston was only in consequence of the vacuum occasioned by the interior of the cylinder being sufficiently cooled so as to condense the steam, this cooled surface must be again presented to the steam during the rise of the piston.
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piston, and must condense steam a second time. The piston cannot rise another inch, till that part of the cylinder which the piston has already quitted has been warmed up to the boiling point, and much steam must be expanded in this warming; for the inner surface of the cylinder must only be raised to the heat of boiling water while the piston rises, but must also be made perfectly dry; and the film of water left on it by the ascending piston must be completely evaporated, otherwise it will continue to condense steam.

On this account, although the counter-weight is not necessary to suck in the steam, the moving force during the ascent of the piston must be considered as resulting chiefly, if not solely, from the preponderating weight of the great pump-rods; and this force is expended partly in returning the steam-piston to the top of the cylinder, where it may be again pressed down by the air, and make another working stroke by raising the pump-rods; and partly in returning the pump-buckets into their places at the bottom of their respective working barrels, in order that they may also make another working stroke. This latter requires force independent of the friction and inertia of the moving parts; for each bucket must be pushed down through the water in the barrel, which must lift up and rise through the valves in the bucket with a velocity proportioned to the velocity of the bucket, in the same degree as the area of the pump-barrel is proportioned to the opening of the valves through which the water must pass.

From this general consideration of the ascent of the piston, we may see that the motion differs greatly from the descent; it can hardly be supposed to accelerate, even if the steam was supplied to the cylinder in ever such quantity; for the resistance to the descent of the pump-bucket is the same with the weight of the column of water, which would cause water to flow through the valves of the buckets with the velocity with which it really rises through them, and this resistance must therefore increase as the square of that velocity increases; that is, as the square of the velocity with which the bucket descends. Independent of the force of friction, and the weight of the valves, the velocity of descent through the water must soon become a maximum, and the motion will become uniform. Accordingly, any one who observes with attention the working of a steam-engine, will see that the rise of the piston and descent of the pump-rods are extremely uniform, whereas the working stroke is very feebly accelerated.

These two motions complete the period of the operation, and the whole may be repeated by shutting the regulator, and opening the injection cock whenever the piston has attained the proper height. For the first two or three strokes, the opening and shutting of the cocks are performed by the attendant; but when he has thus ascertained that all parts are in order, he puts pins into the holes of the plug-frame, and the motion of the engine will then actuate its own machinery, and perform its reciprocations with greater regularity than can be done by hand.

Particulars of different Parts of the Atmospheric Engine.—We shall now pay some attention to the construction of the parts of this engine, and notice some further particulars.

The furnace or fire-place should not have the grate-bars too close as to prevent the free admixture of air, nor so open as to let the coals fall through. About two inches are sufficient for the distance between the bars. The height from the bars to the bottom of the boiler in the centre should not be more than two feet, and the concavity or rife of the bottom in the centre about one foot.

The size of the furnace depends upon the size of the boiler; but in every case the air-hole ought to be capacious, to admit the air. If the flame is conducted in a flue or chimney round the outside of the boiler, or in a pipe round the inside of it, it ought to be gradually diminished from its entrance at the furnace to its egress at the chimney; and the portion of the chimney at that place should not exceed the portion of the flue or pipe, and should also be somewhat less at the chimney-top.

The boiler or vessel, in which the steam is made by the force of fire, may be formed of iron plates, or copper, or of cast-iron, the bottom being of such materials as can withstand the effects of the fire, and have sufficient strength to retain the elastic force of the steam. It may be considered as consisting of two parts; an upper part, which is exposed to the steam, and an under part, which is exposed to the fire. The form of the latter should be such as to receive the full force of the fire in the most advantageous manner, so that a certain quantity of fuel may have the greatest possible effect in heating and evaporating the water; which is best done by making the sides cylindrical, and the bottom a little concave, and then conducting the flame by an iron flue or pipe round the inside of the boiler, beneath the surface of the water, before it reaches the chimney. For by this means, after the fire in the furnace has heated the water by its effect on the bottom, the steam heats it again by the pipe being wholly included in the water, and having every part of its surface in contact with it; which is preferable to carrying it in a flue or chimney round the outside of the boiler, as a third or a half of the surface of the flame only can be in contact with the boiler, the other being spent upon the brick-work. This cylindrical lower part may be left in its diameter than the upper part, and may contain from three to five feet perpendicular height of water in it.

The upper part of the boiler is best made hemispherical for retaining the elasticity of the steam; yet any other form may do, provided it be of sufficient strength for the purpose.

The quick going of the engine depends much upon the capacity of the boiler-top; for if it be too small, it requires the steam to be heated to a greater degree to increase its elastic force sufficiently to work the engine, and then the condensation on entering the cylinder will be greater. If the top is so capacious as to contain eight or ten times the quantity of steam used at each stroke, it will require no more fire to preserve its elasticity than is sufficient to keep the water in a proper state of boiling; this, therefore, is a sufficient fire for the boiler-top.

It is usual to place a damper, or iron slider, in the chimney, or in the flue leading into the chimney; and this has a chain or lever, by which the attendant can regulate the aperture of the chimney, and consequently the draught of the fire, so as to keep the steam to a great regularity: for it is evident, that when the engine works slowly, it will require less steam and fuel than when working rapidly; and without the damper, the engine would be constantly exposed to an excess or deficiency in the supply of steam. The boiler is, in some engines, placed immediately beneath the cylinder, the same as represented in Plate III.; and then the regulator is placed immediately within the boiler, and acts against the under surface of its top, in the same manner as in the first engine of Captain Savery, who invented the regulator.

It was a subsequent improvement of Newcomen's engine to remove the boiler from immediately beneath the cylinder to a small hole on the outside of the engine-house, and smaller in the beam-centre, so as to be carried to a greater height; it is more enabled to withstand the violent shocks to which it is constantly subjected from the working of the engine.
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The greater advantage is, that two boilers can be employed; or when the original boiler requires to be repaired or renewed, it can be replaced by erecting another at one side, and carrying another steam-pipe to the steam-box: in this way the working of the engine can be continued without any stoppage; a circumstance of the greatest importance where the water must be constantly kept drained.

In either case, whether the regulator is placed in the boiler itself, or in the steam-box beneath the cylinder, it is constructed in the manner represented in Plate II. Fig. 2. It is a flat plate of brass, in shape resembling a fan, the upper surface of which applies itself exactly to the whole circumference of the orifice of the steam-pipe, and completely excludes the steam from the cylinder, being moveable round an upright axis, which is accurately fitted into a conical socket coming through the lid of the steam-box. It can be turned aside by a lever, or handle, on the upper end of this axis, so as to uncover or open the passage. The profile shows that, in the section of this plate, there is a protuberance in the middle. This rests on a strong flat spring, fixed below it, across the mouth of the steam-pipe, which spring presses it strongly towards the steam-pipe, causing it to apply very close, and the protuberance slides along the spring, while the regulator turns to the right or left. Both the handle of the regulator, and the end of the rod or spanner, are pierced with several holes, and a pin is put through them, which unites them by a joint. The motion of the handle of the regulator may be increased or diminished, by choosing for the joint a hole near to the axis or remote from it, and the exact position at which the regulator is to stop on both sides is determined by pins stuck in a horizontal bar, on which the end of the handle rests.

The tumbling-bob of the Y has a long leather check-flap fastened to it by the middle, and the two ends of the flap are fastened to the beams above it in such a manner, that the lump may be alternately caught, and held up to the right and left of the perpendicular. By adjusting the length of the two parts of the flap, the Y may be stopped in any defined position. The two legs of the fork spread out from each other, and also from the line of the fluke, thus, and they are of such length as to reach the horizontal pin, which crosses the fork or stirrup of the spanner below.

Now, suppose the pin of the spanner hanging perpendicularly beneath the axis, and the flake of the Y also held perpendicular; carry it a little outward from the cylinder, and then let it go, it will fall farther out of its weight, without affecting the stirrup of the spanner, till the inner leg strikes on the horizontal pin of the stirrup, and then it pulls the pin of the stirrup and the spanner towards the cylinder, and stops the regulator. It thus sets the regulator in motion with a smart jerk, which is an effectual way of overcoming the cohesion and friction of the regulator against the mouth of the steam-pipe. This push is adjusted to the proper length by the check-flap, which stops the Y when it has gone far enough. If we now take hold of the flake of the Y, and move it up to the perpendicular, the width between its claws is such as to permit this motion, and something more, without affecting the stirrup. But when pushed still nearer to the cylinder, it tumbles suddenly towards it by its own weight, and then the other leg of the fork strikes the pin of the stirrup of the spanner in the opposite direction, till the bob is checked by the flap.

Thus, by the motion of the Y, the regulator is open and shut suddenly. This opening and shutting of the steam-passage has an effect in the precise moment that is proper, by placing the pins in the plug-beam, which set upon the handles o and p, at a proper height. For this reason, it is pierced through with a great number of holes, that the places of these pins may be varied at pleasure; this, and a proper curvature of the handles o and p, make the adjustment as nice as we please.

In the same manner the motions of the injection-cock are also adjusted to act at the precise moment that is proper for them. The different pins are so placed in the plug-frame, that the steam-cock may be completely shut before the injection-cock is opened. The inherent motion of the machine, or the momentum of its parts, will give a small addition to the ascent of the piston, without expending steam all the while, and by leaving the steam rather less elastic than before, the subsequent descent of the piston is promoted.

The injection-cock is frequently provided with a tumbling-bob, to make it open suddenly. This is an arm extending from the centre of the F, or lever g, upon which the toothed sector is fixed, and having at its extremity a sufficient weight to open the cock in an instant. When this weight is lifted up to its utmost, the cock is shut, and in this position the weight is detained by a small latch, which is lifted up by a pin in the plug-frame, at the moment when the piston arrives at the top of the cylinder, and thus releasing the weight, it falls all at once, and opens the cock in an instant; but when the piston descends nearly to the bottom, another pin in the plug-frame takes the handle of the sector, and gradually closing the cock, raises the weight till the latch detains it, which happens when the piston is quite at the bottom of its motion.

The injection-cock ought to be opened suddenly; but there is much propriety in closing it gradually: for after the first dace of the cold water against the bottom of the piston, the condensation is nearly complete, and very little more water is necessary, although a continual ascension of water is absolutely required for completing the condensation as the capacity of the cylinder diminishes, and the water which is already injected becomes warmed. It is the continuance of this small injection which prevents the vapour in the cylinder becoming more dense as the piston descends.

The effect of the injection in condensing the steam in the cylinder depends upon the height of the reservoir and diameter of the orifice: if the engine makes a six-feet stroke, then the head and cistern should be at least twelve feet perpendicular above the top of the cylinder. The size of the orifice must depend upon the capacity of the cylinder, as steam will fly by a small orifice, but if the cylinder be very large, it is common to have three or four small holes rather than one large one, in order that the jet may be dispersed more effectually through the whole capacity of the cylinder. The injection-pipe, or pipe of conduct, should be sufficiently large to supply the injection freely with water. The injection-cistern is a common source from which all the parts of the machine receive their respective supplies of cold water. In the first place, the small branch s, which proceeds from the pipe F, immediately below the cistern, and is conducted to the top of the cylinder, has a cock at the end, which must be so adjusted, that no more water will run from it than what will keep a constant supply of a few inches of water above the piston to keep it tight. Every time the piston comes to the top of the cylinder it will bring the water along with it, and the surplus of its evaporation and leakage runs off by a waste-pipe w. This water necessarily becomes alight boiling-hot, and it was thought proper to employ its surplus for supplying the water of the boiler. This was accordingly practised for some time; but Mr. Beighton improved this economical thought by supplying the boiler from the eduction-pipe S, the water of which coming
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coming from the cylinder, must be still hotter than that above the piston.

This contrivance requires attention to several circumstances, which will be easily understood by considering the perspective view. The eduction-pipe comes out of the bottom of the cylinder in an inclined direction, and descends into the hot-well R, where it turns up, and is covered with a valve; in the perspective view may be observed an upright pipe T, which goes through the head of the boiler, and reaches to within a few inches of its bottom. This pipe is called the feeder, and rises about three or four feet above the surface of the water in the boiler; it is open at both ends, and has a horizontal branch from its upper end, communicating with the hot-well R. This communicating branch has a cock, by which its passage may be diminished at pleasure. Now, supposing the steam in the boiler to be very strong, it will cause the boiling water to rise in the feeding-pipe T, and pattering along this branch, to rise also in the hot-well, and run over. The height of the surface of water in the hot-well, above the surface of the water in the boiler, is such, that the steam is never strong enough to produce this effect; but, on the contrary, the water in the hot-well will run off by the branch, and go down into the boiler by the feeding-pipe, as fast as the opening of the cock will admit. These things being understood, let us suppose a quantity of injected water lying at the bottom of the cylinder, it will run into the eduction-pipe S, and open the valve in the bottom, will flow into the hot-well. By properly adjusting the cock on the branch of T, the boiler may be supplied with water as fast as the waffes in steam-engine requires.

The small quantity that is necessary to supply the boiler might be immediately taken from the cold cistern, without sensibly diminishing the production of steam; for the quantity of heat necessary for raising the feline heat of cold water to that of the boiling temperature is small, when compared with the quantity of heat that must be combined with it, in order to convert it into steam. The heat expended in boiling off a cubic foot of water, is as much as would bring six cubic feet to a boiling heat from the temperature of 55°; and little difference can be observed in the performance of such engines as are fed with hot water, and those which have their boilers supplied from a brook. The hot water has, however, the advantage of being free from air; and when an engine must derive all its supplies from pit-water, the water from the eduction-pipe is far preferable to that from the top of the cylinder, because it has been in a measure boiled and distilled.

The interior surface of the cylinder requires to be bored with great exactness; and it must have a sufficient thickness of metal to resist the pressure of the atmosphere, without bending or altering its figure. The piston is made of cast-iron, as nearly as possible to fit the inside of the cylinder, and has all round it, within two inches of the edge, a circular ledge or rim projecting upwards from it, which is both to strengthen the piston, and also to leave a space round between it and the side of the cylinder, to receive the packing or wadding which keeps the piston tight. Mr. Smeaton, who made the best engines on Newcomen's plan, casted the lower surface of the piston to be always planked with elm or beech, about 3¼ inches thick. The planking consisted of two broad planks, crossing each other at right angles, and halved into each other at the interfection, so as to come to an equal thickness; the remaining parts or sectors between the arms of this cross were filled up with pieces of the same plank, well tongued and fitted together, and bolted fast to the cast-iron of the piston with one or two iron rings, let in flat under the lower surface to make it strong; the whole was surrounded with an iron hoop, a quarter of an inch less than the internal diameter of the cylinder. In this case, the cast-iron piston was made less than the wood which formed the bottom of the groove, to receive the wadding, whilst the edge of the cast-iron formed the upright side thereof. The wooden bottom was fitted to the iron with a double thickness of flannel and tar, to exclude the air between the iron and the wood. By this means the piston was less liable to conduct heat; and the wood, being placed with the grain radiating in all directions from the centre, was not liable to expand by the wet. The shank of the piston is made with two prongs, to unite it firmly to the piston; and if the engine is large, it has four prongs, to balance it equally; and the shank must also have two or four chains upon the arch-head. But the chains, when more than one is used, must be united in pairs to the ends of a short horizontal link; and from the middle of this the shank must be suspended, by which means the strain will be equally divided between the two chains. When there are four chains, they must be divided into two pairs, with horizontal links, as above; and the middle parts of these two links must be united to the ends of a longer horizontal link, from the middle of which the shank of the piston is hung; and in this way all the four chains will bear equally.

The upper ends of the chains are jointed to the ends of strong iron bars, supported on the ends of the arch-heads; and at the other ends bolted to the top of the beam, by which means they brace the arch-head.

The original method of making the great working beam was to employ a large tree, and to place the gudgeon or fulcrum under the middle of it, with proper bands to fasten it. The framed beam, represented in the view, was made by Mr. Smeaton: the two middle pieces are formed of whole balks, 12 inches square, put together with the gudgeon as it is now, which is five inches thick, and notched into the beams, to make it keep its place; the ends of the beams are then sprung together, and bolted fast. This being done, another pair of timbers is applied upon the outside of the two former, and others on the outside of these, for the largest engines, making ten balks in the whole. When all these are firmly united, several mortises are cut through between the joints, as shown by the small square marks in the figure; and into these, hard oak wedges are driven, so that they will be half in each beam, and prevent them from slipping or sliding upon each other in the least; and, in this case, the beams act as ties by the longitudinal strength rather than their flexibility. The great beams which suspend the cylinder, and extend across the house, are compounded of several pieces, in the same manner; and the cylinder has a projecting flange from the middle of it, to bolt it down to the beams.

The pump-rods or pins, K, are made of wood, with iron straps let in and bolted to them at each end, to join them together: they are made of fir, which is very good wood, and it will bear a great strain endways, if the iron straps are well fitted, and can be obtained in very long pieces. When a mine is of a considerable depth, the pumps cannot be made to lift the whole at once; but the pit must be divided into two, three, or four lifts, and as many different pumps employed; each lifting the water into a cistern, for the supply of that which is above it. Fifty yards are as much as is proper for each lift, but in some very deep mines they are obliged to make them more. It is very difficult in these cases, to make all the pipes sufficiently strong to bear the pressure of the water, particularly the shock which takes place
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place when the whole column of water falls upon the valves in shutting: the blow which they then make is like the stroke of a forge-hammer, and soon beats every thing to pieces. The only effectual remedy is the addition of an air-velvet at the side of the pump; but in general the miner makes a hole in the suction-pipe of the pump, just below the plunger, and fixes in a cork, with a small valve opening outwards: through this they admit a certain quantity of air every time the pump draws, and this air, mixing with the water in the barrel, condenes, when the valves shut suddenly, and by its elasticity eases the violence of the shock. When the mine is pumped almost dry, the engine will draw a little air at every stroke, at the bottom of the pipes; and this answers the same purpose. See a description of a new pump for mining in our article PUMP.

Rules for determining the Proportions of Atmospheric Engines.

—Mr. Newcomen brought forward his engine at a time when almost all the valuable mines in England were coming to a stand for want of more powerful or cheaper machines than were then known; and in consequence, in a few years his invention was put in practice at almost all the mines then existing; and new ones were opened in situations where it would have been impossible to have done it before. The first perfect engine which they erected at Grift, in Warwickshire, had only a 22-inch cylinder, and it was many years before any were made so large as 36: those which we now call small engines, were so much more powerful than any former means of draining water, that they were amply sufficient, until the mines, by growing deeper, required more power. The most obvious means of increasing the force was to change the cylinder for a larger one, and this was most frequently done one or more times; and then, when the beam and other parts would bear no greater strain, a new and larger engine was erected. In this manner they proceeded for many years, until, by gradual increase, the cylinders for common use had reached the enormous powers of 50, 60, and 72 inches diameter.

When it became impracticable to extend them much larger, engineers began to consider the means of improving their performance without increasing their dimensions: also, the consumption of fuel in these large engines was so serious an expense, as to balance the profits of many mines.

At first the fuel was not considered as an object, because the steam-engine, on the whole, was found so much cheaper than any other means of draining water. The best engineers were those who made engines which would fulfill the task assigned to them, and, in comparison to their dimensions and expense of erection, would draw the most water, and be the most certain in the continuance of their operation. We have no accounts of the quantity of fuel consumed by any of those early engines, in proportion to the water which they raised to any given height; but the rules by which they apportioned their cylinders to the work to be performed have been preserved.

Defaguliers tells us, that Mr. Newcomen's way of finding the power of his engine, was to square the diameter of the cylinder in inches, and cut off the left figure, and then call it long hundred weights; and writing aoyer on the right hand, he called the number on that side odd pounds: this he reckoned tolerably exact at a mean, or rather when the barometer was at 30 inches, and the air heavy. The effect of cutting off the left figure from the square of the diameter, is to divide the number of superficial circular inches on the piston's surface into portions of 16 circular inches each; and the pressure on each of these portions is estimated at a long hundred weights; 120 lbs. therefore, the pressure will be

\[
\frac{120}{10} = 12 \text{ lbs. per circular inch, or } 12 \times 3.1416 = 37.68 \text{ lbs. per square inch for a circular area of } 16 \text{ in.}^2.
\]

This, however, must be considered as the full pressure of the atmosphere, if the vacuum was perfect. But to compensate for imperfection, Newcomen allowed between one-third and one-fourth part, and also for what is lost in the friction of the several parts, and for accidents. Now, instead of the long hundred of 120 lbs., he would have the

\[
\frac{120}{10} = 12 \text{ lbs. per circular inch, or } 144 \text{ lbs. per square inch, which is still nearer the medium pressure of the atmosphere.}
\]

Defaguliers says this rule will agree pretty well with the work at Grift engine, there being lifted at every stroke between two-thirds and three-fourths of the weight of the atmospheric column preying on the piston; i.e. between 10 and 11 lbs. on each square inch. To give the estimation in round numbers, the diameter of the cylinder of Grift engine will be 22 inches; this squared is 484, cut off the left figure, and we have 48 cwt. 40 lbs. for the preasure of the atmosphere. The column of water in the pumps weighs about 274 cwt., to which adding the weight of 73 yards of iron rods, equal about 9 cwt., the weight lifted at the end of the beam would be 564 cwt., from which we must subtract about 4 cwt. for the piston, and the other weight at that end of the beam, reducing the load to 32 lb. cwt.; so that the weight of the atmosphere being 45 cwt. 40 lbs. raises a weight of 32 cwt. with a velocity of six feet in two seconds, conferring only the descending stroke of the piston. This requires an effective pressure on the piston of nearly 11 lbs. per square inch, including friction and counter-weight; but to balance the weight of the water in the pump, demands a pressure of only 8 lbs. per square inch of the piston.

In calculating the powers of the steam-engine, it has been a common mistake with engineers to take into the account no other circumstances than the diameter of the cylinder, and the perpendicular height and diameter of the pumps; from which they calculate only what burden is laid upon each square inch of the cylinder or piston area, supposing the piston to be at rest, but without paying any regard to the velocity of the engine's motions under such burden, or the number of strokes per minute. Without taking these particulars into the account, it is impossible to calculate the quantity of water raised to a given height, which is the only means of obtaining the exact power or acting force of an engine: it would be like attempting to measure the contents of a solid body by only two dimensions. Steam-engines have different times been calculated to carry a load varying from 5 lbs. to upwards of 10 lbs. to the square inch; but when working with the light pressure of 5 lbs. to the inch, they are expected to go with double the velocity; that is, the piston to move through double the space in the same time that it would with a pressure of 10 lbs. In this case the same quantity of water would be raised to a given height in the same space of time; in the steam-engine, as well as in other machines, there is a maximum, which cannot be exceeded without applying some new principle; and though by bad workmanship an engine may fall short of what it should do, the best workmanship can only produce a certain effect.

In estimating the power or effect of engines in this manner by the pounds per inch in the area of the piston, it must be considered as the clear product of the engine in the column of water it will raise, abstracted of all deductions for friction, counter-weight, &c. For, by attending to the different lifts of pumps in the engine-shaft of a coal or a copper mine, we find that we must, beside the altitudes and diameters, take into the account the friction of the buckets, and of the water on the sides of the pumps; the
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opening of strong double-leathered valves, together with the stones and gravel that enter at the foot of the pump; the inertia of the pump-roads, the chains, the massive lever placed between the cylinder and the pumps, all to be overcome by the preffure on the piston, in addition to the 7 or 8 lbs. per square inch. These additions to the power required for the mere raising of the water are so considerable, as to be at least equal to half what is required for the work performed: this will raise the real acting preffure of the atmosphere to 104 or 115 lbs. per square inch. When this is the case, the vapour which remains in the cylinder must be equal in preffure to 45 or 53 lbs. per square inch; and this, by our first table of expansion, will indicate a temperature of from 15° to 14° of Fahrenheit.

In general, the water in the hot-well indicates a lower temperature than this; but although we have but little information concerning the rate of the vacuum in the atmospheric engines, when working in their usual state, it must be considerably more perfect than has been suggested by the idea of a preffure of 8 lbs. per inch; for an engine carrying a load of 75 lbs. on the square inch of the piston, together with the friction and inertia, even in large engines, cannot be less than 114 lbs. on the inch. Mr. Hornblower informs us that he tried the vacuum of several engines in the county of Cornwall; and in one, which was reckoned the least, he had 24 inches, instead of 30 inches, at which it would have had if the vacuum was perfect. If we take the extreme of these observations, it will be 11.6 lbs. on each square inch.

Mr. Henry Beighton seems to have been the first who reduced the steam-engine to any degree of certainty in its calculations, and laid down the rules for calculating its powers. Beighton was a mathematician as well as an engineer, and conducted the Ladies Diary from 1714 to 1744. For several years he lived at Griff, and had constant opportunities of trying experiments on engines.

We have before noticed his invention of the working-gear, or mechanism, by which the regulator and steam-cock are alternately opened and shut. In 1717, Mr. Beighton published the following table of the necessary proportions of the cylinders of engines to the pumps, when drawing water at different depths, from 15 to 100 yards, in different quantities, from 48 to 480 hogheads per hour.

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<th>Diameter of the Cylinders, Inches</th>
<th>Cylinders.</th>
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<tbody>
<tr>
<td>Gallons</td>
<td>Lbs.</td>
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<td>10.2</td>
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<tr>
<td>10.6</td>
<td>9.0</td>
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<tr>
<td>8.8</td>
<td>8.1</td>
</tr>
<tr>
<td>7.1</td>
<td>5.66</td>
</tr>
<tr>
<td>6.2</td>
<td>5.0</td>
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<tr>
<td>5.5</td>
<td>4.3</td>
</tr>
<tr>
<td>5.0</td>
<td>3.61</td>
</tr>
<tr>
<td>5.0</td>
<td>3.13</td>
</tr>
<tr>
<td>5.0</td>
<td>2.51</td>
</tr>
<tr>
<td>5.0</td>
<td>2.03</td>
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</table>

This table is formed on the foundation of the ale-gallon, (containing 282 cubic inches,) which, when filled with pure running water, weighs 10 lbs. 3 oz. and 70 cubic inches; and a superficial inch, on a vacuum, takes in about 14 lbs. 13 oz. of the atmosphere, when the mercury stands in a medium in the barometer.

But allowing for several frictions, and to give a considerable velocity to the engine, experience has taught us to allow but little more than 8 lbs. to an inch in the cylinder's base, that it may make about 16 strokes in a minute, at about six feet each.

An Example for the Use of this Table.-Suppose it was required to draw 150 hogheads per hour, at 90 yards deep; in the seventh column, I seek the nearest number, viz. 149 hogheads, and against it, in the first column, I find a pump of seven-inch bore; then under 90, the depth on the right hand in the same line, I have 27 inches, the diameter of the cylinder fit for that purpose, and so for any other. Henry Beighton.

This estimation of 8 lbs. preffure for each square inch continued for many years to be the rule with engineers who constructed their engines according to this proportion; and if the engines were of a better or worse construction, they would move with a greater or less velocity, because all the excess of preffure which could be obtained above the 8 lbs. was appropriated to overcome the friction and inertia of the machine; and also to raise the counter-weight: if, therefore, this additional quantity was greater or less, the engine would move quicker, and raise a greater quantity of water.
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water in the same time. Mr. Brighton expected his engine to move 16 strokes  per minute, of six feet each, or 96 feet of motion per minute; but succeeding engineers found these seldom to come up to this, and then began to diminish the burden to 7 lbs. per square inch, and even 6 lbs., in order to obtain a greater velocity of motion.

The celebrated engineer Mr. John Smeaton carried the engine of Newcomen to perhaps as great a degree of perfection as its principle admitted. Having constant occasion to employ large steam-engines in the great works which he executed, he turned his attention to consider the means of improving their effect, and diminishing the consumption of fuel. In calculating the proportions for an engine for the New River Company, in 1757, he considered that the stoppage of the water at every stroke, as well as putting the lever-beam, piston, heavy rods, and chains, from a state of rest into motion, twice at every stroke, was a great loss of power; he therefore determined to work the engine slower, and with larger pumps, and put upon the piston all the load it would bear. To reduce the velocity of the column of water still more, he would place the fulcrum of the beam out of the centre, and make the stroke of the piston nine feet, while the pump, which lifted 6 feet, should work with only six feet stroke. This arrangement obliged him to employ a long narrow cylinder, of only 18 inches diameter, and from this he also expected to obtain other advantages; viz. that every part of the steam, being nearer the surface of the cylinder, would be more readily condensed; and, in consequence, that a less quantity of injection-water would serve the cylinder, which would itself be more heated. Under all these appearances of advantage, he ventured to burden the piston with a preasure of 70.4 lbs. per inch. Thus, area of piston (18 inches diameter) 254; weight of the column of water 96 feet in the pumps, 18 inches diameter, 35,960 lbs., of which take 3 lbs. for the difference of the length of Stroke, and gives 2640 lbs. for the weight to be lifted by the piston; and dividing 2640 by 254, the area of the piston, gives 10.4 lbs. preure per inch. "Having once seen a common engine struggle under this burden, I thought myself (says this ingenious engineer) quite leuer under those advantages; but now great was my surprize and mortification, to find that, instead of requiring less injection-water than common, although the injection-pump was calculated to as much injection-water as usual, in proportion to the area of the cylinder, with a sufficient overplus to answer all imaginable wants, it was unable to support the engine with injection; and that two men were obliged to assist to raise the injection-water quicker by hand, to keep the engine in motion: at the same time that the cylinder was so cold, I could keep my hand upon any part of it, and bear it for a length of time in the hot-well. By good fortune, the engine performed the work it was appointed to do, as to the raising of water; but the coals by no means answered my calculation. The injection-pump being enlarged, the engine was in a state of doing business, and I tried many smaller experiments, but without any good effect, till I altered the fulcrum of the beam so much, as reduced the load upon the piston from 104 lbs. to 82 lbs. per inch. Under this load, though it shortened the stroke at the pump-end, the engine went so much quicker, as not only to raise more water, but consume less coals, took less injection-water, the cylinder became hot, and the steam-engine was at last the same in a cylinder of Fahrenheit; and the engine in every respect not only did its work better, but went more pleasantly. This at once convinced me that a considerable degree of condensation of the steam took place in entering the cylinder, and that I had lost more this way by the coldness of the cylinder, than I had gained by the increase of load. In short, this single alteration seemed to have unfettered the engine; but in what degree this condensation took place under different circumstances of heat, and where to strike the means as upon the whole to do best, was still unknown to me. But resolving if possible, to make myself master of the subject, I immediately began to build a small fire-engine at home, that I could easily convert into different shapes for experiments, and which engine was very near ready to set to work in the winter of 1769."

With this experimental engine, which is representet in Plate III. Steam-Engine, Mr. Smeaton made a multitude of experiments, which he noted down with great care in tables, and from their results deduced rules for the proportions of the parts of his engines: he afterwards erected many engines of the largest dimensions, which fully verified his experiments; the first of these was at Long Benton colliery, in 1774, which had a 52-inch cylinder, and afterwards a 72-inch, for the empress of Ruffia, at Cronfalta.

Mr. Smeaton's Experimental Engine.—Plate III. contains an elevation of this engine, shewing all its parts at one view; and, after the minute description which we have given of Mr. Newcomen's engine in Plate II., it is not necessary to enlarge on the particulars of the present. A, B, are the walls of the building; C groundflats, extending from the wall B, to the wall of the boiler or furnace; D are strong upright timbers, to support the cross-beams d, on which the centre of the beam is fullscreened; P are the cylinder-beams, framed into the upright D, and the walls A, B; and the cylinder G is hung between them by thick cross-planks g, g.

M is the great beam, librating on its centre, and formed to arcs of circles at the ends, to which are fastened the chains b for the piston, and the chain of the main-pump over H. It has also attached to it the plug-frame Q, and at the other end an iron rod k, which works the injection or jack-head pump, I, by means of a counter lever a a, which brings the rod, i, of the pump to a convenient place, near the main-pump O O'. The proper distance for the motion of the beam is limited by two iron fixds or pins b, b, which reach out from each side of the arch-heads, and stop on pieces of wood, supported by the beams S, called the forming-beams. The beam a, which supports the upper floor of the house, are let into the walls A, B, at the ends, and rest in the middle on the cross-beam d, and are firmly bolted down, as shewn in the drawing.

N is the injection-pipe, n the injection-cock, and X the piston water-cock, branching off from the injection-pipe N, L is the injection-cittern, placed in the highest part of the house; k k is the pipe from the injection-pump I, by which it is supplied; and T is the waste-pipe, at which the excess of water runs off. The pipe T leads down to the small cittern s, which will always be kept full, and the overflow will run down the waste-pipe t, and escape out of doors.

f is the fire-door, and the ash-pit is beneath it: the fire circulates round the boiler, and then passes into the chimney: p is a small door at the bottom of the chimney, to clear the foot, and there is also a damper to regulate the draft: n is the boiler, and its figure below is shewn by the dotted lines: w is a pipe rising from it, which has the safety-valve at the top of it, contained in a box or trough, which carries the steam through the wall at w: s is the steam-gauge, a small height of tube, which contains mercury, and shews the preasure of the steam. The cylinder G, besides the bored part in which the piston works, has a bottom W, screwed on by a flanch at the lower part, and from this bottom part descends the steam-beam s. The short pipe, x, joins to the lower end of the injection-pipe N N; and opposite
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opposite to this is a similar short pipe, for the snifting-valve. Also from the bottom of the cylinder there descends the funk, or education-pipe s, which enters the hot-well R, and the end is covered with a valve. S is the waft-pipe, from which the excess of hot water in the hot-well is carried off into the well E E.

As the hot-well is placed so low that the boiler cannot be supplied from it, a small feed-pipe, p, proceeds from the lower part of the cylinder, and enters the boiler, having a cock, p, to regulate the quantity which shall pass through, and a valve to prevent the water being drawn up from the boiler into the cylinder. In the top of the boiler is the regulator-plate, 7, to the under surface of which the regulator is fitted: the handle or lever of the regulator is also seen, and the spanner or rod 5, by which it is alternately moved backwards or forwards by the arms 3 and 4 of the \(\Delta\). When its weight or bob, 3, falls over on either side of the perpendicular, it is checked by the trap 9; 1 and 2 are the arms or handles by which the \(\Delta\) is moved when the pins in the plug-beam, Q, act upon them, and \(\delta\) is a weight to balance the weight of the handles.

10 is the E, or lever of the injection-cock; it is connected with the handle of the cock, 13, by a fork, which cannot be seen; and the end, 11, is loaded with a sufficient weight to cause its descent, and open the cock, except when it is elevated, by pressing down the end 10; and when it is held up by the hook 12, the cock will then be shut; but when the plug-frame rises to its highest, it draws the wire 14, and lifts the catch 12, so as to let fall the weight 11, and opens the cock in an instant.

The action of this engine is apparent after the explanation which we have given of the former engine, and it is only necessary to explain a small machine which is called the citera \(\Phi\), called the citera or citera \(\Phi\), it was very commonly used in the engines for draining foundations, or other temporary works. It had a pulley or wheel, to receive the chain which communicated motion from the piston to the pump-rod, instead of a beam; and the whole machine being supported in one frame of wood, it had no connection with the building in which it was placed, or it could work all together in the open air. The frame was shaped like the letter A, and the vertex supported the pivots of the wheel, which the cylinder and pump were bolted down to the ground fulks, on which the A was erected. The engine in its action was the same as others; the boiler required no setting in brick-work, but was in the shape of a large tea-kettle, and the fire-place was in the centre of it, surrounded on all sides by the water. On one side was an opening for the fire-door, and a large tube or pipe led through the water to a hollow sphere of cast-iron, in which the fire was made, upon a grate; and from the grate another large tube or ash-pit descended perpendicularly through the bottom of the boiler, and was open below to supply air to the fire; also opposite the fire-door was a small large tube or chimney, leading from the sphere through the side of the boiler, and it then turned up in the manner of the spout of a tea-kettle, to carry off the smoke into a tall chimney of brick or of iron-plate.

From Mr. Smeaton's manuscript papers (now in possession of Sir Joseph Banks) we gain much practical as well as philosophical information on the atmospheric engines; and as these engines are still used very extensively at coal-mines, we think the publication of the particulars will be of service.

Mr. Smeaton's experiments with his experimental engine were very numerous, and so diversified, as to afford all the information which can be derived upon Newcomen's engine. It would exceed our limits to transcribe many of these experiments; but we think it will be serviceable to give the table of proportions, which he settled from the results of all his experiments, and after which table, between the years 1774 and 1785, he erected no less than eight first rate engines, with cylinders of five and six feet diameters, and many others of smaller dimensions. A full description, with drawings, of one of these engines, is given in the publication of Mr. Smeaton's Reports, 3 vols. 4to. London, 1811.
Mr. Smeaton's Table for the Proportions of the Parts of Newcomen's Engines, deduced from actual Experiments.

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STEAM-ENGINE.

The different columns of this table explain themselves, except the great product per minute. This is the effect of the engine expressed in a convenient manner, to separate it from all considerations of the diameter or lift of the pumps, or of the number of strokes which the engine makes in a minute; being the multiple of all these, and is thus obtained. Multiply the square of the diameter of the cylinder in inches, by the preffure on each square inch of the piflon, not expressed in pounds weight, but in the height of a column of water in feet; and this again is multiplied by the velocity of the motion of the piston per minute. For example, a 26-inch cylinder: square of diameter, \(676\times 18\) feet, the preffure per square inch in feet of water, \(= 12.6 \times 76.21\) feet, the journey per minute, \(= 927333\), the great product per minute, as per table. The table is calculated upon the supposition that the preffure upon each square inch of the piflon is 8 lbs. avoirdupois, or 18 feet column of water.

The last column, or effect per minute of one bushel per hour, is a comparative view of the effect of different-sized engines, showing the advantages of large engines in respect to small, in the quantity of work they will effect in proportion to the coal they consume.

To find the number of bushels of coals which any of the engines will consume per hour, calculate the internal surface of the cylinder in square inches, and add to it three times the square of the diameter, to allow for the piflon bottom, cylinder bottom, and the surface of the pipes which are within the cylinder. Next calculate the solid content of the cylinder in cubic inches, and find the proportion between the superficial and the solid measure of the cylinder: according to the number of this proportion, find a number in the following table for a divisor.

<table>
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<th>Proportion of the Surface of the Cylinder to its Capacity in square and cubic Inches.</th>
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Lastly, cut off three places of figures from the great product per minute, and dividing by the divisor, the quotient will be the effect of one bushel per minute.

For example, a 72-inch cylinder: its circumference will be 326.3, which, multiplied by 135 inches, the length, gives 30550 square inches; and adding thereto 15558, which is three times the square of the diameter, we have 46102 superficial inches; and the content of the cylinder is 549852 cubic inches, which is 110 times the number of the superficial inches. By seeking in the last table for 11.9 or 12, we find the number 572 for the divisor of the great product, after cutting off its three last figures, viz. 7558 \(\div 572\) = 13 bushels per hour.

By this way of finding the proportion between the surface and the content of the cylinder, an allowance is made for the loss of steam which takes place from condensation, when it enters into the cylinder at every stroke, after it has been cooled by the injection thrown into it.

The quantity is very considerable, and forms the greatest objection to this form of the steam-engine. An attentive observation to the action of an engine will shew that there is a waste, but not the quantity in which it takes place. The moment the regulator is opened, when the piston is at the bottom of the stroke, the steam may be perceived to issue from the stuffing-valve with a strong puff, because the steam is more elastic than air by one or two pounds per square inch; but as the piston rises, this steam diminishes, and soon ceases, and no more steam will issue during the whole rise of the piston.

To ascertain the quantity of this loss by condensation, it becomes first necessary to know to what degree water is expanded, when converted into steam, at the preffure of the might be, and compare this with the degree of expansion which it requires to convert the water, which the boiler consumes in a given time, into such a quantity of steam as will fill the cylinder the requisite number of times in the same period.

Mr. Beighton made an experiment at Griff engine, in Warwickshire, on the degree of rarefaction of water when converted into steam, but without determining the temperature. The preffure of the steam was just one pound upon the square inch, as he determined by the reed-yard of the fly-serve; and by our second table, we find this to denote a temperature of about 210°. The cylinder of the engine contained 113 gallons of steam at every stroke, which, at 16 strokes per minute, is equal to 1808 ale-gallons, or 1808 \(\times 8\) = 14464 pints of steam per minute. He found that the necessary supply of fresh water for the boiler, under these circumstances, was about five pints per minute, to keep the surface of the water at a constant level; therefore, the relative bulk of the steam of one pound per inch preffure, and the water from which it was produced, were as 5 to 14464, or as 1 to 2893 nearly. By an unaccountable rule, Delaugiers, who relates the above experiment, deduces from the same data, that the expansion is 13488, a number which has been frequently quoted by other writers. Mr. Beighton's experiment cannot be admitted as conclusive, because the cylinder being cooled by the condensing water at every stroke, the steam would be condensed, and lose much of its bulk in entering into the cold cylinder. But without making any allowance for that loss, Mr. Beighton's experiment makes a greater degree of expansion than has been found by others; and we should not have mentioned this experiment at all, had it not been so frequently quoted after Delaugiers with his enormous error, even by Belidor, Prony, and other foreign writers.

Mr. Smeaton made some experiments by weighing a Florence flask of four inches diameter, first when it was perfectly dry and empty, and afterwards when it was full of water; then pouring out all the water, except a small quantity, he put the globe on the fire, and made it boil strongly, till the last drop of water disappeared, and at that instant he stopped up the mouth to retain the steam which was within it. The flask being now weighed, gave the difference of weight between the flask filled with water and with steam of an elastic force equal to that of atmospheric air; and deducting the weight of the empty flask from each of these experiments,
ST. EAM-ENGINE.

experiments, it gave the proportion of the bulk of the steam to that of the water: this, by a mean of fixx different experiments, he determined to be as viii vii. But supposing that some air was contained in the flasks along with the steam, he inverted the mouth of it in water when it was filled with the hot steam, and found it to draw up the water in the same manner as after seeing by captain savery; but it was not quite filled with water, for a small bubble of air remained in the flask, and this he estimated to be such a portion of the whole content, as induced him to reduce his estimate of the expansion from 2450 times to 1800 times; and this number, the same number that Mr. Watt had determined, he used in his calculations.

His investigation of the quantity of steam destroyed by a given surface of the cold cylinder was as follows. The cylinder of the experimental engine was 9.9 inches diameter and 50 inches long making the requisite additions to its bottom and piston, the internal surface was 2340 square inches, and the solid content was 3940 cubic inches. The quantity of water necessary to supply the boiler at each stroke was found to be 8.7 cubic inches; which 3940 divided by 8.7, was 463 times, which the 8.5 cubic inches of water must have expanded to fill the cylinder at each stroke. But supposing the water to have expanded 1800 times, the 8.5 inches x 1800 = 15300 cubic inches of steam produced, which is 3.88 times the quantity employed to fill the cylinder. The difference of these numbers, viz. 15300 - 3940 = 11360 inches of steam condensed and lost. This, divided by the number of superficial inches on the surface of the cylinder, gives 4.9 cubic inches condensed by every square inch of surface.

It will be readily seen, that the proportion between the quantity of steam which must be produced, and the quantity which will be employed, will be less in large cylinders than in small ones; hence the above is the extreme case; and in a similar trial of a 52-inch cylinder, he found the waste to be only 2.7 cubic inches for each inch of surface. Hence we see the reason for Mr. Smeaton's rule of making the proportion of the surface of the cylinder to its capacity the ground-work for the calculation of the quantity of coal.

In common engines, which are loaded to seven or eight pounds upon inch, and which are of a middle size, the quantity of steam which is condensed in refilling to the cylinder the heat which it had lost, is equal to the full content of the cylinder, besides what it really required to fill it; so that twice the contents of the cylinder are employed to make it raise a column of water equal to about seven or eight pounds for each square inch of piston; or to take it more finely, a cubic foot of steam makes a sufficient vacuum to raise a cubic foot of water about eighteen feet high, besides overcoming the friction of the engine, and the resistance of the water to motion.

In all Mr. Smeaton's experiments he observed the quantity of water which was evaporated in proportion to the coal, and found by a mean of a great number of experiments, that a bushel of coal evaporated 12700 cubic inches of water, or 7.35 cubic feet; and estimating the expansion at 1800 times, the bushel of coal will produce 13230 cubic feet of steam, of little more in elasticity than the atmosphere, and about 214 degrees Fahrenheit's thermometer.

The Work actually performed by Atmospheric Engines in proportion to the Coal.—We shall first give the results of the performance of some old engines, according to Mr. Smeaton's account, before he began his improvements. The engine at Long Benton colliery, which was considered as one of the best in the neighbourhood of Newcastle, was tried by Mr. Smeaton in 1772; it was of the following dimensions. Cylinder 52 inches diameter, stroke 7 feet. The pump was 12 inches diameter, and drew the water 61 fathoms high; and also an injection-pump 8 inches diameter, and 5 feet 7½ inches stroke, which raised water 58 feet. This engine consumed 8 bolls (of 2 cwt. 1 qr. 21½ lbs. each) of coals, such as are generally used for engines, in two hours and two minutes, when working at the rate of from 7 ½ to 8 strokes per minute, or 7 ½ per minute at the medium.

The computations from these data are first to ascertain the real weight of water in the pumps; the main pump being 12 inches diameter, and the injection-pump 8, the proportion of the areas of the two will be as the squares of their diameters, and their load in proportion to their height of column; therefore, as 144.445.88 feet high; 25.7 feet; that is, the whole load of the injection-pump will be equal 25.7 feet of the main column of 12 inches diameter; but this is, provided that the length of stroke was the same in both.

To reduce them to one, say as a 7 feet stroke, or 84 inches, : 07.5 in. :: 25.7 ft. : 20.7 feet of the column of the main pump, say 21 feet.

Hence, the whole load consists of the main column of 12 inches diameter, and 61 fathoms or 366 feet, and the injection-pump equal to 21 feet thereof, 366 + 21 feet = 387 feet.

To obtain what Mr. Smeaton calls the great product, by which the powers of different engines can be compared, multiply the square of the pump's diameter 144 inches X 387 feet lift = 55728, which multiplied by a 7 feet stroke = 36006, and again by 7.75 strokes per minute = 303244, the whole product or effect of the engine, regardless to coal, or without any allowance for the weight of the pump-rod, and the counterpoise of the engine.

The quantity of coal was 2 cwt. 1 qr. 214 lbs. = 2734 lbs. x 8 bolls = 2188 lbs. which divided by 88 lbs., the weight of a London bushel, gives 24.86 bushels consumed in the whole time of the experiment, viz. two hours and two minutes, or 122 minutes.

To find the coals for one hour's work, say as 122 minutes : 60 min. :: 24.86 bushels : 1.2 bushels per hour.

Lastly, the whole product 303244, divided by 12.2, gives 247401 for the product or effect of one bushel of coal per hour.

This engine was rebuilt according to Mr. Smeaton's plan, with the same cylinder of 52 inches and 7 feet stroke, but the pumps were enlarged to 12.3 inches diameter, and lifted in two columns each 24 fathoms 4 feet high. The injection-pump was 7 inches diameter, 5 feet 6 inches stroke, and lifted 70 feet 7 inches high.

In 1774 Mr. Smeaton tried the experiment, and found that when this new engine was working at the rate of twelve strokes per minute, a cwt. 1 qr. 16 lbs. of the common engine coals supplied it 22 minutes.

From this he made a similar computation to those for the former engine. Square of 12.3 inches the diameter of the main pumps 148.84; square of 7 inches the diameter of injection-pump 49; its lift 70.5 feet. Then say as 148.84 : 49 : 70.5 : 23.21 feet of the main column, if the lengths of the strokes were equal; but as they are not, say as the long stroke 84 in. : 66 in. :: 23.21 ft. : 18.2; therefore the load of the injection-pump is equal to the load of 18.2 feet of height of the main column.

The total load then is equal to a barrel 12.2 inches diameter, twice 24 fathoms 4 feet, or 296 feet + 16 feet, viz. 314 feet of lift.

To obtain the great product, multiply the square of the pump's diameter 148.84 by 314 feet; the height lifted = 5 46735.76.
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46735.76, which multiplied by 7 feet stroke = 32150.121
and again by 12 strokes per minute = 382780.24 for the whole product or effect of the engine, without regard to coals, or without allowance for the weight of the pump-rod, nearly 3 tons, and the counter-weight of the engine.

For the quantity of coals 2 cwt. 1 qr. 16 lbs., or 268 lbs., divide it by 88 lbs., the weight of a London bushel, and it makes 3.05 bushels consumed in 22 minutes, the time of the experiment; therefore say, as 22 min. : 60 min. :: 3.05 : 8.32 bushels per hour.

Lastly, the whole product 392804.84, divided by 8.32, gives 471851 for the product, or effect of one bushel of coals per hour. Therefore the effect of this new engine, compared with the former engine, is as 471851 to 247401.

To this computation, which is chiefly comparative between the two engines, we may add the following, to show the pressure upon each square inch of the piston. The area of the 52-inch cylinder is 52 x 52 = 2704 x .7854 = 2123 square inches.

The weight of the column of water in the pumps, 12.2 inches diameter, will be about 50.08 lbs. weight for each foot in height. For 12.2 x 12.2 = 148.34 x 7.854 = 116.8, the square inches of the area of the cylinder, we have the weight of the column of air into which the water will rise, with the square inches of the area of the piston. If we multiply 116.8 by one, the square inches in a square foot, and it will give 434 lbs., which is the weight of a column of water one inch bale and one foot high. Multiply 116.8 x .434 = 50.7 lbs., the weight of the column of water in the pumps a foot high; and this multiplied by 314 feet, the whole lift equals 15010 lbs., the total weight of water.

Divide this number by 2123, the number of square inches in the surface of the piston, and it will give 7.14 lbs. for the pressure upon each square inch, 7.14 very nearly, and a very small number.

Another method of readily finding the pressure per square inch in the piston is thus. As the square of the diameter of the cylinder (52 x 52 = 2704) is to the square of the diameter of the pump (12.2 x 12.2 = 148.34), so is the height which the pump lifts, 314 feet, to 17.24, the height of a column of water, which, if it refted on the piston, would balance the water in the pump. Then multiply 17.24 feet by 434 lbs., the weight of an inch square of water one foot high, and the result is 7.48 lbs. for the pressure per square inch, the same as before.

Since Mr. Smeaton introduced his improved engines, it has been customary to compare their effects by the number of pounds of water which they can raise to one foot high by the consumption of a bushel of coals, without regarding the time in which it is expended. To reduce these two engines to that standard, we must say the first engine consumed 24.86 bushels in 122 minutes; therefore, as 24.86 bu. :: 122 min. :: 1 bu. :: 49 min.; that is, one bushel will lift 49 minutes.

At every stroke, the pump draws up a cylinder of water, 12 inches diameter and 7 feet long, 387 feet high. This cylinder of water will weigh 343 lbs.; for 12 x 12 = 144, x .7854 = 113 inches, the area of the pump. This, multiplied by .434 lbs., the weight of a column one inch square, and one foot high; will be 49 lbs.; and again, multiplied by 7 feet for the length, will equal 343 lbs.

The quantity of coals consumed in the first experiment was 24.86 bushels; the experiment lasted 122 minutes, during which time the engine, working at 7 1/2 strokes per minute, made 945 strokes; then say, as 24.86 bu. :: 945 strokes :: 1 bu. :: 38; therefore the engine makes 38 strokes for every bushel of coals which it consumes.

At every stroke the engine raises 343 lbs. of water 387 feet. Multiply 343 by 38, the number of strokes, and it gives 13034 lbs., hit 387 feet by each bushel of coals. Lastly, 13034 x 387 = 5044,158 lbs. of water raised one foot high with a bushel of coals.

The new engine consumed 3.05 bushels in 22 minutes, during which time it worked 12 strokes per minute; it is therefore 264 strokes; then say, as 3.05 bu. :: 264 strokes :: 1 bu. :: 86.5, the number of strokes which the engine will make for each bushel it consumes.

At every stroke the engine raises a cylinder of water, 12.2 inches diameter, 7 feet long, and weighing 354.8 lbs. 314 feet high. Multiply this 354.8 lbs. by the 86.5 strokes which the engine makes for each bushel of coals, and we have 30690, the number of pounds of water lifted 314 feet by each bushel of coals. And lastly, 30690 lbs. x 314 feet

= 9,636,660 lbs. of water lifted one foot high with each bushel of coals.

Mr. Smeaton's Directions for making Engines. — Mr. Smeaton made his engines with a wooden bottom to the piston, as we have before noticed. This was because wood communicates heat much less rapidly than metals. The piston is kept much cooler than any other part to which the steam has direct access, not only from the water which is poured upon it to keep it tight, and prevent the leakage of the steam, but also from the conduction of the cold injection-water; and as the steam in entering the cylinder through the steam-pipe first meets the cold surface of the piston, it is thereby condensed in a greater degree than by an equal portion of the internal surface of the cylinder. By covering the bottom of the piston with wood, it will receive or conduct less heat from the steam; and for the same reason, the cold water, when it is thrown upon against the piston, will be less heated by the contact of it, the wood acting as a neutral body on the fluid, which alternately acts as a conductor.

The injection-cap, or jet, according to Mr. Smeaton, should be a square hole through a brass plate, and rounded from the under side, that it may throw up a full bore. The middle of the jet should not be directed to strike the centre of the piston bottom, but it should rise perpendicularly, so as to strike the piston bottom at right angles. That part of the injection-pipe which is within the cylinder should be made of wood, or if of metal, wrapped round with tarred marine, or small rope, to separate the metal of the pipe from the condensation of the steam, or hot water, which not only faves the conduction of some fume, but by preventing the pipe becoming hot, that portion of injection-water which is contained in the pipe is kept cool, and the steam which afterwards flows through the pipe will enter in its coolest state. The injection-cylinder should be placed as high as the building will admit, so as to give a smartness to the jet.

A pipe should be applied beyond the stuffing-valve, with a cock in it, which being partially closed, the stuffing can be regulated, if it should be found too great, so as to emit more steam than is requisite. Mr. Smeaton also placed a small air-cock on the upper part of the eduction-pipe, or some other part having free communication with the cylinder, for the largest engine. This was to be only the size of a small common beer-cock; and when the cock was properly regulated, this cock was to be opened as much as it could be, to allow the piston to come fully down into the cylinder. We suppose this air-cock must have been found practically beneficial, or such an experimental engineer as Mr. Smeaton would have discontinued to recommend it; but we do not know on what principles the admission of air could be serviceable, unless it was to diminish the defending power of the piston when it arrived near the bottom of the cylinder, and thus diminish that acceleration of the piston, of which we
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we have before spoken in the description of the action of the engine.

Lastly, in adjusting the engine to its work, to determine the proper degree of counter-weight, it was to be put together, and the pumps filled with water, but the buckets without the leathers, and the piston without any packing. In this state, a weight, equal to about 1lb. per square inch, being laid upon the piston, the engine was ballasted at either end of the beam, as it might require, until it was found in exact balance. Then, when the piston was relieved from its weight, it would have a counter-weight tending to draw it up with a force equal to 1lb. per square inch. This was for engines of the largest dimensions; but as the proportion of loss by friction of the piston and buckets is greater in small cylinders and pumps, smaller engines must have 1½lb., and the smallest engines 1½lb. per inch. When it is not convenient to fill the pumps with water up to the top, allowance must be made for the difference of the pump-rod not being immersed.

Mr. Smeaton expected his engines, which were calculated to be loaded with a neat burden of 8lbs. per square inch, would, with the counter-weight as above, make their returning stroke rather quicker than the working stroke, and this he preferred. The proper proportion of the counter-weight has been a matter of much mathematical investigation by writers on the engine, particularly M. Boffist; but it depends upon so many contingent circumstances, that it would be impossible to apply any theorem to practice, even if the theory were established; and the adjustment is easily ascertained by experiment.

The design of the engineer in giving or allowing a preponderancy to the outer end of the beam, is simply that the buckets may descend, and that the piston may rise and allow the steam to fill the cylinder, without any further combination of apparatus being employed for that purpose. Now let us observe its operation, and the manner of adjusting its quantity in an engine's first setting to work. Suppose the water already up to the top of the pump; the steam being admitted into the cylinder till it has driven out the air, the operator shuts the steam-cock, without supplying any injection; and the engine will make its first stroke, though very quietly, by the external condensation from the surface of the cylinder: he then allows steam again to enter the cylinder, and according to the piston's tendency to rise, he suits his judgment to the degree of counter-weight necessary: if it rises too low, he puts iron or other ballast upon the pump-end of the beam; and if it rises too quick, he places these weights on the piston-end. We have then two important circumstances to attend to in this regulation. First, that the pump-bucket shall descend as quick as it can, but without such force as shall occasion a violent shock to stop the motion at the end of the strokes; and secondly, that the piston shall not be drawn up faster than the steam-regulator (with the degree of opening that is given to it) can supply steam; for that would impede the discharging functions of the engine, or getting rid of the air and condensing water; and unless these are performed punctually, the engine soon ceases to work. Now neither the air nor the water can be discharged instantaneously from the cylinder, but require a certain time, in proportion to the quantity of each, and the degree of strength in the steam; and therefore the piston must not rise so quick as to prevent the steam acting on the air and condensing water, which it will do if the engine has too great a counter-weight, and the steam is low; for if the piston ascends faster than the boiler supplies steam, there can be no discharge, and after a stroke or two the engine will stop.

But this is on the supposition that the engine is working with its full intended velocity. When an engine is erected on a mine or pit which is sinking, the quantity of water to be lifted by the pump being small, the engine must work slowly, and the counter-weight must be in proportion; the beam will nevertheless require an extra counterpoise at the pump-end, because of the lightness of the pump-rod; but as the mine or pit becomes of greater depth, and successive lengths of rods are applied for the different lifts of pumps, the weight must be diminished, and at length transferred to the piston-end of the beam, in such quantity as to keep the engine under command; for as the velocity of the returning stroke depends upon the quantum of counter-weight, this must be regulated according to the quantity of water which this engine has to draw, or rather to the number of strokes the engine is to make in a minute. As this velocity is to be increased when the quantity of water increases, a greater counter-weight must be added; but it is not until the engine works at its intended load, that the counter-weight must be brought to the degree we have mentioned.

While an engine is working, as we have supposed, with a small portion of its full load, the injection must be very sparingly applied, fo as to condense imperfectly within the cylinder, or the piston will descend with such velocity, and strike upon the spring-beams with such violence, as to beat every thing to pieces.

When a mine is going down, and the engine-shaft receives all the water from the different parts of the mine, the quickness of the engine's stroke must depend upon the uniform influx of the water, and the engine must be so accurately regulated to the pint of the load, as to stop it up at every stroke. Now if this stopping up is violent, the air will be drawn into the pumps at the conclusion of every stroke, and cause the engine to work irregularly; and, on the other hand, if the strokes of the engine are not quick enough, the water will gain on the miners and prevent their working. The velocity, as we have before stated, must be regulated by the quantity of injection which will determine the motion of the stroke, and the counter-weight will regulate the time of the returning stroke: but a much better regulation of the velocity of the engine can be attained by the cataracts, which we have before described.

Even when the engine comes to work with its full load and counter-weight, and when a proper injection is allowed to condense fully, the engine-man can retard or accelerate the returning strokes of the engine, in some degree, by the regulation of the fire; for if the engine should return too quick, he lets down the damper in the flue of the chimney; or if it is too slow, he raises the damper. By these means he can vary the action of the steam, on the lower side of the piston, from one to two pounds on the inch, greater than the prensure of the atmosphere, which in a sixty-inch cylinder will amount to 2800 pounds, and is sufficient for the engine return very quick or very slow, but does not alter the period of the working of the stroke.

Other Improvements on Newcomen's Engine.—Mr. Smeaton's improvements on the engine, as we have shewn, consisted only in proportioning its parts, but without altering anything in its principle.

In 1759, Mr. James Brindley, the engineer who designed and executed the duke of Bridgewater's canal, obtained a patent for improvements in the structure of the fire-engine. The boiler he proposed to be made of wood and stone, with a cast-iron flue or fire-place within of it, and surrounded
STEAM-ENGINE.

rounded on all sides, so as to give its heat to the water. The chimney was an iron pipe or tube, also immered in the water of the boiler. This plan he expected would save a considerable portion of the fuel. The feeding-pipe for the boiler was to be made with a clack, to be opened and shut by a float upon the surface of the water in the boiler, so as to supply it with water always to the same level, without any care on the part of the engine-man. The great chains for the arches of the beam were to be of wood, and his pumps were also to be made of wooden flates hooped together. These are all the improvements mentioned in the specification of his patent; but in the new edition of the Biographia Britannica, we are informed that, in 1756, Mr. Brindley undertook to erect a steam-engine near Newcastle-under-Lyme upon a new plan. The boiler of it was made with brick and stone, instead of iron plates, and the water was heated by internal iron flues of a peculiar construction, by which contrivances the consumption of fuel necessary for working a steam-engine was reduced one-half. He introduced also into his engine wooden cylinders, made in the manner of cooper's ware, instead of iron ones, the former being cheaper and more easily managed in the shafts; and he likewise substituted wood for iron in the chains which worked at the end of the beam. He had formed designs of introducing other improvements into the construction of this useful engine, but was discouraged by obstacles that were thrown in his way.

The most important improvement in the atmospheric engine was the application of it, by means of a crank and fly-wheel, to the purpose of turning mills. This was not much invention to any one who had considered the action of a foot-lathe; but it does not appear to have been put in practice till a late period, or brought into any extensive use till after Mr. Watt invented his engine. Mr. Jonathan Hills had a patent in 1756, for working rowing-wheels at the side or head of a boat by the force of Newcomen's engine, and we believe he proposed to employ a crank, to produce the rotary motion of the wheels.

In 1759, Mr. Keane Fitzgerald propounded, in the Philosophical Transactions, a contrivance to work the ventilator by the fire-engine, for the benefit of those who work in mines, where it is employed to draw off the water. By this contrivance the lever of the fire-engine, which works up and down, and performs at a medium about twelve strokes in a minute, is made to turn a wheel constantly one way, and the number of strokes is also increased to fifty or sixty in a minute. The machine is described by three figures annexed to the memoir, and is considered as ingenious. It is stated that it may easily be made to turn a mill to grind corn, or a wheel to raise coals.

It is related in the Encyclopaedia Britannica, that Mr. Fitzgerald took out a patent for communicating a rotative motion from the steam-engine, but we believe this is a mistake. In the Edinburgh Review it is stated, that an atmospheric engine was employed at Hartley colliery, in Northumberland, as early as 1768, to draw coals out of a pit. It had a toothed sector on the end of the working beam, working into a trundle, which, by means of two pinions with ratchet-wheels, produced a rotative motion in both the ascending and descending arch of the sector; and by shifting the ratchets, the motion could be reversed at pleasure. This engine had no fly-wheel, and went sluggishly and irregularly. Who the inventor was is not mentioned.

A patent was taken out in 1769 by a gentleman of the name of Stewart, for an engine which produced a rotative motion by a chain going round a pulley, and also round two barrels furnished with ratchet-wheels, with a weight suspended to the free end of the chain, which served to continue the motion during the return of the engine. About the year 1778, Mr. Matthew Wathbrough, of Bristol, also obtained a patent for communicating a rotative motion from the steam-engine, by a method which was virtually the same as that at Hartley; only he added a fly-wheel, which we believe was then, for the first time, employed in the steam-engine. Two or three of these engines were erected, one at his own works, for turning lathes, &c. and also one at Southampton, at Mr. Taylor's works, besides two or three for grinding corn; but, owing to the defective mode of communicating the motion, they were subject to such irregularities as rendered them of little use.

The crank, which is now the universal method of communicating the motion of the engine to machinery, was, we believe, first applied to an engine at Birmingham. This method of converting the reciprocating motion into a continuous rotary motion, was by employing a great beam to work a crank or train of wheelwork. As the real action of the engine was confined to its working stroke, it was soon found advantageous to equalize, as nearly as could be, the power of the working and returning strokes. For this purpose, the rod which extended from the beam to the crank, and connected the engine and the mill together, and which is called the connecting rod, was made equal in weight to half the power of the engine, being made of cast-iron of large dimensions; and when the weight was not in the rod, it was placed on the beam at that end.

Suppose that by this means the engine is made to exert an equal force to turn round the crank in the ascent and descent of the connecting rod, still it remains to find some force which shall continue the motion in the interval of its change from ascending to descending, and vice versa. To accomplish this, it is necessary to connect with the crank or wheel-work a very large and heavy fly, which shall accumulate in itself the whole force of the engine during its time of action; and therefore continue the motion, and urge forward the working machinery, while the steam-engine is going through its inactive period of changing the crank or train of wheelwork. This will be the case, provided that the resistance exerted by the machine during the whole period of the working and returning stroke of the steam-engine, together with the friction of both, does not exceed the whole preface exerted by the steam-engine during its periods of action upon the crank; and provided the momentum of the fly, arising from its weight and velocity, be sufficiently great; so that the resistance of the work, during the changing of the stroke of the steam-engine, will not make any very sensible diminution of the velocity of the fly. This is evidently possible and easy, for the fly may be made of any magnitude; and being exactly balanced round its axis, it will soon acquire any velocity conincident with the motion of the steam-engine.

During the working stroke of the engine, it is uniformly accelerated; and by its acquired momentum, it produces the movement of the mill until the engine changes, and makes its returning stroke; but in doing this, its momentum is shared with the inert matter of the steam-engine, and consequently its velocity diminished, but not entirely taken off. The weight of the connecting rod, therefore, by preying on the crank affrelish during the returning stroke, increases the remaining velocity in the fly, by a quantity equal to the whole that it lost during the inactivity of the engine. This must be acknowledged to be a very important addition to the engine; and though sufficiently obvious, it is ingenious, and requires considerable skill and address to make it effective.

Mr. John Steed, in 1781, had a patent for applying the crank to a steam-engine; and in the same year, the abbé Arnal
STEAM-ENGINE.

Mr. Curr's Table of Proportions for the Parts of Atmospheric Steam-Engines.

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In all these engines, he supposes the length of the stroke to be nine feet, and that they work 8 1/2 feet stroke in common work.

In 1793, Mr. Francis Thompson had a patent for making the atmospheric engine work a double stroke, for the convenience of turning machinery by a crank; this he effected by employing two cylinders, one inverted over the other, and the piston of both connected by one rod, which passed through the bottom, or rather the top, of the inverted cylinder, and was connected with the beam: by this means the cylinder acted alternately to make an up or down stroke. This never came into use, for the engine was as complicated as Mr. Watt's, without any of his advantages.

Mr. Watt's Steam-Engine.—The principle of this valuable invention will be best explained by a statement of the manner in which it originated, and the steps by which it attained its present degree of perfection.

Mr. James Watt was, in 1763, a maker of mathematical instruments at Glasgow, and being a man of truly philosophical mind, and well conversant with all branches of science, he was in habits of associating with the most celebrated scientific men at that time in Scotland, particularly with Dr. Black, Dr. Roebuck, and Dr. Robison, then a young philosopher. About this time he undertook to repair a working model of a steam-engine belonging to the university of Glasgow, and during this employment, observed the great loss of steam from the condensation of the cold surface of the cylinder, which we have before explained in Mr. Smeaton's investigations, though the latter were not made till after Mr. Watt's. He observed that a great quantity of heat is contained in a very minute quantity of water, in the form of elastic steam; for when a quantity of water is heated several degrees above the boiling point in a close digester, if a hole be opened, the steam rushes out with great violence, and in three or four seconds, the heat of the remaining water is reduced to the boiling heat. If the steam be condensed, the whole of it will afford only a few drops of water; yet this small quantity, in the state of steam, carried off with it all the excess of heat from the water of the digester. Mr. Watt reasoned, that if so great a quantity of heat is contained in a certain quantity of steam, the economical use of the steam was a matter of the first importance in the improvement of the engine, more than the construction of the furnace, which had been the chief object of former efforts to improve the engine, the improvement of the application of the steam having been much neglected after it was first settled by Beighton.

The cylinder of the little model was heated when the steam was in it, so that it could not be touched by the hand; but before a vacuum could be made, it required to be cooled by the injection, and then was to be heated again by the re-entrance of the steam; this, he feared, could not happen, unless the heat was abstracted from the steam, which must occasion the condensation and wastage of a considerable portion. His first enquiry was, what portion of the steam was thus wasted; but so few experiments had been made, even upon the most essential part of the subject, that the real bulk of water, when converted into steam of a given heat, remained unknown, until he determined it by new experiments in the year 1764. The opinions which had been entertained concerning its bulk before that time were much beyond the truth, and could by no means be deduced from the very inaccurate experiments which were said to have been made. Thus
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Thus furnished with data, he was enabled to ascertain that the loss of steam, in alternately heating and cooling the cylinder, was not less than three or four times as much as would fill the cylinder and work the engine. The boiling of water in an exhausted receiver at low heats, which had been discovered, we believe, by M. Coulomb, was about this time communicated to Mr. Watt; but it was neither known what these heats were, nor what proportion they observed under various prehures, before he made his experiments on this subject. These experiments produced another defect of the common steam-engine, viz. that the injection-water thrown into the cylinder to condense the steam becoming hot, and being in a vessel exhausted of air, it produces a steam or vapour, which in part refills the prehure of the atmosphere upon the piston, and leffens the power of the engine: this might be remedied by throwing in as much water as would cool the whole vessel below the point at which water boils in vacuo; but then it would increase the first-mentioned inconvenience, which is the destruction of steam that unavoidably happens upon attempting to fill a cold cylinder with that fluid. Others, who had constructed steam-engines, found, that as they made their exhaustion more perfect by making the cylinder colder, they increased the consumption of steam in a greater proportion than they gained power. Though it appears they were ignorant of the cause, they were so sensible of the effect, that they contented themselves with causing the engine to raise a load equal to seven pounds upon the square inch of the area of the piston; whereas the prehure of the atmosphere would have raised much more, if the cylinder had been perfectly exhausted.

Mr. Watt's first attempt at the improvement of the engine was by employing a wooden cylinder, which would transmit the heat more slowly: this had some effect, but did not answer in other respects, and he was obliged to abandon it, as well as Mr. Brindley, who had before tried the same thing. He then caled his metal cylinders in a wooden cale with light wood-ashes: by this, and using no more injection than was absolutely necessary for the condensation, he reduced the waste almost one-half. But by using so small a quantity of cold water, the inside of the cylinder was hardly brought below the boiling temperature, and there consequently remained in it a steam of very considerable elasticity, which robbed the engine of a proportionable part of the atmospherical prehure.

It was not until the next year (1765) that Mr. Watt made his great invention of performing the condensation in a separate vessel from the cylinder. He conceived, that if a vessel, which he afterwards called the condenser, was made to communicate with the cylinder by a pipe, and filled with steam at the same time, an injection being thrown into the latter vessel would condense the steam therein, and cause a vacuum. Under these circumstances, the elasticity of the steam in the cylinder would cause it to rush into the vessel to restore the equilibrium; but this steam being condensed immediately it entered the vessel by the continuance of the injection, the vacuum would fill remain, and draw off the remaining steam from the cylinder until some was left. Here then was the vacuum in the cylinder produced, without any necessity for diminishing the temperature below the boiling point. Having thus obtained the vacuum to cause the defect of the piston, the subsequent re-äsent could be obtained by cutting off the communication between the cylinder and the condenser, and admitting into the former a fresh supply of steam from the boiler; but it was not necessary to admit any fresh steam from the boiler to the condenser, as the vacuum produced therein still continued, and it would be ready to receive and condense the steam from the cylinder, as soon as the piston arrived at the top of it, ready to make another stroke.

The first difficulty which opposed itself to this beautiful chain of reasoning was, how to continue the action, and prevent the separate condensing vessel from filling with the injection-water, and also how to get rid of the air. To shift by blowing steam into the vessel, in the manner of the former engine, would have caused him as great a waste of steam from condensation, as he would have by all his discovery. He then thought of condensing without injection, simply by the application of cold water to the outside of the condenser, on Savery's first plan; and to get rid of the small quantity of water produced by the condensation of the steam, he intended to carry a pipe down from the condenser to a depth of 34 feet, from the end of which the water would run off by its gravity. But the air which is carried over by the steam would also accumulate by descents, and could not be so easily evacuated; a small pump then would be to draw it off, and keep the condenser empty.

Mr. Watt at the same time conceived, that it would be very advantageous to employ the prehure or expansive force of the steam to actuate the piston in its deficient, instead of the prehure of the atmosphere, as it would be more manageable than the other in its intensity. Thus was the whole discovery made in a day; and it only remained to invent the details of the mechanism to carry it into effect, and to establish by experiment the requisite proportions of the parts.

Mr. Watt's first experiment on these new ideas was to try the effect of the separate condenser; but before he had made the apparatus for the experiment, he resolved to extract the condensed water from his condenser by means of the same pump which should draw off the air, as this method would be applicable in all situations.

The first apparatus was a cylindrical vessel, fitted with a piston, which could be drawn up in it to exhaust the air therefrom. This vessel was made to communicate, by means of a long pipe half an inch in diameter, with the cylinder of the engine, which was two inches in diameter, and ten inches long. The pipe had a stop-cock, to cut off the communication at pleasure; and the cylindrical vessel, which was made of thin tin-plate, was immersed in cold water. The piston of the cylindrical vessel being pressed to the bottom to displace the contained air, was then drawn up to leave a vacuous space, and the cylinder of the engine, having its piston at the top, was filled with steam. The cock in the communicating pipe being then opened, the piston descended with a velocity, which showed that the vacuum in the cylinder was almost perfect; and he found, that when he used water in the boiler purged of air by long boiling, nothing that was very sensibly inferior to the prehure of the atmosphere on the piston could hinder it from coming quite down to the bottom of the cylinder. This alone was gaining a great deal; for in most engines, the remaining elasticity of the steam arising from the heated injection-water was not less than one-eighth of the atmospherical prehure, and therefore took away one-eighth of the power of the engine.

Mr. Watt was so much occupied in other business, that it took him much time to complete his machine, and bring the whole to bear, so that he did not apply for his first patent until 1768, which bears date 5th Jan. 1769, and is for his method of leffening the consumption of steam and fuel in fire-engines. The specification contains the following principles.
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"First. That the vessel in which the powers of steam are to be employed to work the engine, which is called the cylinder in common fire-engines, and which I call the steam-vessel, must, during the whole time that the engine is at work, be kept as hot as the steam that enters it; first, by enclosing it in a case of wood, or any other material that transmits heat rapidly; secondly, by furnishing it with steam, or other heated bodies; and thirdly, by suffering neither water, nor any other substance colder than steam, to enter or touch it during that time.

"Secondly. In engines that are to be worked wholly or partially by condensation of steam, the steam is to be condensed in vessels distinct from the steam-vessels or cylinders, although occasionally communicating with them. These vessels I call condensers; and while the engines are working, these condensers ought at least to be kept as cold as the air in the neighbourhood of the engines, by applications of water, or other cold bodies.

"Thirdly. Whatever air, or other elastic vapour, is not condensed by the cold of the condenser, and may impede the working of the engine, is to be drawn out of the steam-vessels or condensers by means of pumps, wrought by the engines themselves, or otherwise.

"Fourthly. I intend, in many cases, to employ the expansive force of steam to press on the pistons, or whatever may be used instead of them, in the same manner as the pressure of the atmosphere is now employed in common fire-engines. In cases where cold water cannot be had in plenty, the engines may be wrought by the force of steam only, by discharging the steam into the open air after it has done its office.

N. B. This should not be understood to extend to any engine where the water to be raised enters the steam-vessel itself, or any vessels having an open communication with it.

"Fifthly. Where motions round an axis are required, I make the steam-vessels in form of hollow rings, or circular channels, with proper inlets and outlets for the steam, mounted on horizontal axles, like the wheels of water-mills. Within them are placed a number of valves, which suffer bodies to go round the channels in one direction only. In these steam-vessels are placed weights, so fitted to them as entirely to fill up a part or portion of their channels, yet rendered capable of moving freely in them by the means hereinafter mentioned or specified. When the steam is admitted into these engines, between the weights and the valves, it acts equally on both, so as to raise the weights to one side of the wheel, and by the reaction on the valves, successively to give a circular motion to the wheel; the valves opening in the direction in which the weights are preffed, but not in the contrary one, as the steam-vessel which moves round it is supplied with steam from the boiler, and that which has performed its office may either be dischaged by means of condensers, or into the open air.

"Sixthly. I intend, in some cases, to apply a degree of cold, not capable of reducing the steam to water, but of conveying it considerably, so that the engines shall be worked by the alternate expansion and contraction of the steam.

"Lastly. Instead of using water to render the piston or other parts of the engines air and steam-tight, I employ oils, wax, refrangible bodies, fat of animals, quicksilver, and other metals, in their fluid state."

Soon after his patent, Mr. Watt became associated with Dr. Roebuck, who established the Carron iron-works. They proposed establishing an extensive manufactory for such engines under the patent; and Mr. Watt began his first real engine of 18 inches cylinder, at Kinnell, near Borrowstounness. This was a sort of experimental engine, and was successively altered and improved till it was brought to considerable perfection. In the details of its construction, the greatest difficulty of all was in the packing of the piston, so as to be steam-tight; because Mr. Watt's principle did not admit of water being kept on the piston to prevent the leakage, as in the old engines. He found great difficulties in procuring a cylinder sufficiently accurate, until a new method was introduced at Durham foundry, by Mr. John Wilkinson. In the old method of boring, the instrument which performs the part of cutting the metal was guided in its progress only by the incorrect form given to the cylinder by the mould; and though it infurred that every part of the cylinder should be circular, it gave no certainty that the cylinder would be straight. This was quite sufficient for the old engines, but Mr. Watt's engines required greater precision. Wilkinson's machine, which is described in our article Cylinder, infures all the accuracy the subject is capable of; and if the cylinder should be cast ever so crooked, the machine will bore it straight and true.

Dr. Roebuck becoming embarrased, from the failure of his vast undertaking in the Borrowstounness coal and salt works, was unable to prosecute the manufactory of steam-engines, and, in 1774, disposed of his interest in Mr. Watt's patent to Mr. Matthew Boulton, whose establishment at Soho, near Birmingham, was then the most complete in England, and conducted with the most spirit. A portion of the works was allotted to Mr. Watt, who erected a foundry, and the necessary works to carry his invention into effect, on a grand scale.

In consequence of the great loss of time, and the enormous expense necessary for bringing the engine to perfection, Mr. Watt was not able to produce any large engines, as specimen of his invention, until 1774; and found, from the difficulty of introducing them, that the term of his patent was likely to pass away before he should be reimbursed: he, therefore, applied to parliament for a prolongation of his term, which was granted for 21 years, by an act passed in 1775. With this encouragement, and with the advantage of Mr. Boulton's alliance in systematizing the manufacture of the parts, Mr. Watt soon produced many capital engines, which were ered at Staffordshire, Shropshire, and Warwickshire, and a small one at Stratford near London. He found it was necessary to admit a small jet of injection-water, of sufficient dimensions to extract both the condensed steam and injection-water, as well as the air; for the condensation, by the application of external cold, was not sufficiently rapid, and the engine was so much improved as to afford amply for the power requisite to work the air-pump.

The condensing of the steam, by injection into the admission-pipe, was an idea as early as the other kinds of condensers, and was tried in the very first engine built at Kinnell; but the other imperfections of that machine, owing to its leaky and bad workmanship, made it unsuitable, and this being attributed to the air which came in with the injection-water, Mr. Watt diffused the injection into the condenser, until the size and expence of the tubulated condenser for large engines, made him resolve to sacrifice a part of the power of the engine to convenience, and to employ larger air-pumps. In an engine at Bedworth, three air-pumps were used, two below, which were side by side, and worked by chains from each side of the beam, and a third above these two, and between these, a third one received the hot water lifted up by the other two; and by leaving the surface exposed to the pressure of the atmosphere, extracted the water with
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with greater ease. In 1778 he only employed two air-pumps for the largest engines, one being double the area of the other, and there was used only one, as at present, which is the air-pump of Smeaton.

A sketch of one of these first engines is given in Plate IV.

Steam-Engine, fig. 4. The cylinder, and great beam, with its arch-heads and the pumps, stood in the same position as the former engines; but the cylinder, A, was smaller in proportion to the load than those before used, as it was generally loaded to 1½ pounds on the square inch. The cylinder was very accurately bored within side, to make it straight and cylindrical, and externally it was surrounded by a second cylinder, or jacket B B, leaving a small space, G, all round between the bored or internal cylinder, and the outer jacket B.

This space, G, communicated by a large pipe, F, with the boiler, and always remained full of steam, so as to keep the cylinder, A, at the same heat with the steam, and thereby prevent any condensation within it, which would have been a much greater loss than an equal condensation on the external surface of the jacket B. The jacket, B, was furnished with a lid, C, which had a hole in the centre for the piston-rods, a, to pass through. The rod was made truly cylindrical, so that the hole could be kept steam-tight by a collar of oakum screwed round it at E. The inner cylinder, A, had a close bottom, and the jacket, B, joined to the same, the cylinder being fitted with the piston H H, as usual; but the top of the internal cylinder, A, did not reach quite up to the lid of the jacket B, or outer cylinder; by which means the steam had always free access to the top of the piston, H, from the space, G, between the cylinders, and consequently from the boilers through F. At the bottom part of the inner cylinder there were two regulating valves, O and K, one of which, O, either admitted the steam to pass from the interval, G, between the jacket and the cylinder, through a passage, I, into the space of the interior cylinder below the piston, or shut out the steam from that space at pleasure: the other valve, K, opened or shut the end of the eduction-pipe M, which conducted to the condenser L. The condenser, L, was a close vessel, made of thin metal, and furnished with an air-pump N. The air-pump had valves, and a bucket, d, for exhausting the air, and drawing off the water which was produced by the condensation of the steam, along with which the air is extracted from the water in boiling, and rises with the steam. The air-pump was constructed nearly the same as a common pump, except that it had a lid or cover on the top of the barrel, to keep the pressure of the atmosphere from bearing constantly upon the bucket. The rod, a, of the bucket passed through a stuffing-box in the lid, and was suspended by a chain from the great working beam of the engine. The condenser, L, together with the air-pump N, were placed in a large cistern of cold water X, situated generally under the floor of the engine-house, between the cylinder and the wall on which the beam rested, and supplied constantly with fresh cold water from a small pump worked by the engine, or the cistern was placed outside of the wall, between the wall and the pit of the pump.

The action of this engine is as follows: suppose steam from the boiler to enter at F, and fill the space, G, between the jacket and the cylinder, and also the upper part of the cylinder above the piston. The condenser, L, is exhausted of its air, by opening both valves, O and K, in the bottom of the cylinder, and allowing the steam from the space, G, to blow through it, and through the valves of the air-pump: both valves are then shut, and the external cold condenses it so as to leave a vacuum in the condenser, whilst the cylinder, A, is all the while full of steam, from the space G, both above and below the piston H: the steam-valve, O, being shut, cuts off all communication with the under side of the piston from the steam in G, or in the boiler, and at the same time the eduction-valve, K, from the condenser is opened, when the steam rushes from the space of the cylinder A, below the piston, through the eduction-pipe M, into the vacuum of the condenser, with great violence, till it comes in contact with the cold sides of the condenser L, which is made of thin metal, and immered in cold water. Under these circumstances the steam is immediately deprived of its heat, and reduced into water; more steam immediately rushes in from the cylinder, until it is exhausted, and makes a vacuum beneath the piston H. The steam which is above the piston ceasing to be counteracted by the steam which was below it, presses between the top of the piston and the bottom of the lid, C, with its whole elastic force, and causes the piston to descend to the bottom of the cylinder, carrying along with it the beam, and raising the pump-buckets at the other end. The exhausting-valve, K, is then shut, and the steam-valve, O, opened, which allows the steam to enter below the piston, leaves it at liberty to rise; in which case, the superior weight of the pump-rods raises the piston on the top of the cylinder, ready to commence another stroke.

The advantages that arise from this construction are these: the cylinder, being surrounded with the steam from the boiler, is always kept uniformly as hot as the steam itself, and is therefore, incapable of destroying any part of the steam which should fill it, as the common engines do. Secondly. The condenser being kept always as cold as water can be procured, and colder than the point at which it boils in vacuo, the steam is perfectly condensed, and does not oppose the descent of the piston; it is, therefore, forced down by the full power of the steam from the boiler, which is somewhat greater than that of the atmosphere. Thirdly. The elaticity of the steam being employed to press down the piston, instead of the pressure of the atmosphere, the air does not enter the cylinder, or cool its interior surface; and the engine is not confined, as is the former engine, to work with its whole force, but it is only to administer steam of a proper elasticity, and we can vary the force of the engine very considerably, without losing any more fuel than that for which we obtain the effect.

When an engine of the old form is to be erected, the engineer must make an accurate estimate of the work to be performed, and must proportion his engine accordingly. He must be careful that it be fully able to execute its task; but its power must not exceed its load in any extravagant degree. This would produce a motion which is too rapid, and which, being alternately in opposite directions, would occasion jolts, which no building or machinery could withstand. Many engines have been shattered by the pump’s drawing air, or a pump-rod breaking; by which accidents, the steam-piston descends with such force and rapidity, that every thing must give way. But in most operations of mining, the task of the engine increases, and it must be so constructed, at first, as to be able to bear this addition. It is very difficult to manage a common engine when it is much inferior to its task: the only mode of as, as we have described, by the supply of a scanty injection; but the easiest way is to work the engine almost full loaded, and that only during a few hours each day, allowing the pit-water to accumulate during its repose. This increases the first cost of the erection, and wastes fuel; the miners are also much incommoded with water during the inaction of the engine. Mr. Watt’s engine can, at all times, be exactly fitted, during the working stroke, to the load of work that then happens to be upon it: it is only necessary to administer steam of a proper elasticity. At the first erection of the
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engine, it may be calculated equal to twice its task, supposing that the steam admitted above the piston is to be three or four pounds per square inch more elastic than the atmosphere; but when the engine is first set to work, it may be made to act with a small portion of its force, by using weaker steam; for when once the ebullition in the boiler is fairly commenced, and the whole air is expelled from all parts of the apparatus, it is evident that, by damping the fire, the steam of half this elasticity may be continually supplied, and the water will continue boiling, although its temperature does not exceed \(15^\circ\) of Fahrenheit's thermometer. This appears, by inspecting our first table of vaporous elasticity.

The method now proposed has one inconvenience; for, while the steam is weaker than the atmosphere, there is an external force tending to squeeze the fides and bottom of the boiler, which could not be refilled in a large boiler, if the difference was considerable, and common air would rush in through every crevice of the joints of the engine. The regulation of the velocity of the engine may be produced by diminishing the passage for the steam into and out of the cylinder; for this purpose, the exhaustion-valve, \(K\), by which the steam passes away from the cylinder, may be so contrived, that its mechanism will lift it more or less high from the conical face in which it is lodged, and consequently the passage can be enlarged or contracted at pleasure, by the distance to which the valve is drawn up. The degree of opening given to the exhaust-valve would determine the rate at which the steam would flow off from the lower part of the cylinder to the condenser, and consequently the velocity of the descent of the piston; also the degree of opening of the other, or steam-valve, \(O\), would determine the rate of the ascent of the piston, by regulating the rate at which the steam could pass from the boiler into the lower part of the cylinder.

But to save the trouble of making the adjustment for the degree of opening of the working-valves, it is better to place a separate valve in some part of the steam-pipe, \(F\), which brings the steam from the boiler to the jacket of the cylinder; then if this valve, which is called the throttle-valve, and is solely for the purpose of regulation, be partially closed, so that it will not admit steam into the jacket as fast as the descent of the piston makes room for it in the cylinder, it is evident that the flow of steam will be less; and being there condensed, the jet will follow till none remains; then the steam, flowing through the throttle-valve, and passage \(d\), into the top of the cylinder, presses down the piston into the vacuum cylinder, until it arrives at the bottom; the exhausting-valve, \(K\), is then shut, and at the same time the steam-valve, \(O\), is opened by the plug-frame: this suff ers the steam from the boiler to rush into and occupy that small portion of the bottom of the cylinder beneath the piston, which being filled with steam of an equal density to that above it, there will be an equal preasure on both sides of the piston and the opening of the valve, \(O\), having made a free communication between the top and bottom of the cylinder, the piston is at full liberty to rise by the action of its counter-weight, until it arrives at the top of the cylinder, and then the steam-valve, \(O\), is shut, and the exhausting-valve, \(K\), opened, to make another stroke, as before.

The sketch in fig. 2, was taken from an engine of Mr. Boulton and Watt erected at Hull, in 1779; and this, with some slight variations in the manner of its action, which we shall afterwards describe, is the present standard engine for pumping water: the variety of the regulating-valve, \(F\), is made to open and shut at every stroke, and for regulation, another valve is applied in the steam-pipe just before it arrives at \(F\).

In the two engines which we have described, the piston descends in consequence of the preasure of the steam being
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made to act upon it whilst there is a vacuum beneath; and the ascent is made, when the piston is placed in equilibrio, by an open communication being made between the upper and lower parts of the cylinder; and this will always be an exact equilibrium, not imperfect, as in the old engine, where the varying pressure of the steam and of the atmosphere always renders the circumstances in which the piston rises uncertain.

It is evident that the ascent of the piston may be as well performed in vacuo, provided the vacuum is made at the same time both above and below the piston. This form of the engine is represented in fig. 4, in which, as the same letters of reference are used, it is needless to repeat the description of the cylinder and piston. F is the valve which admits the steam to the top of the cylinder, to press upon the piston: this valve is shut when the engine makes its return or up-stroke. K is the exhaust-valve, placed close beneath the steam-valve W, instead of being at the bottom of the pipe W, which descends to the condenser, and gives off a branch, I, to the bottom of the cylinder; by this pipe the steam is always drawn off from the bottom of the cylinder, to keep a constant vacuum therein. Suppose the exhausting-valve, K, open, the steam in the top of the cylinder will also pass off to the condenser through the pipe W, and leave a vacuum in the whole cylinder: in this case the piston rises freely by the counter-weight to the top of the cylinder; and being arrived there, the exhausting-valve, K, is shut, and the steam-valve, F, opened. The steam from the boiler entering into the top of the cylinder, and preffing between the lid and the top of the piston, presses down the latter to the bottom of the cylinder, where being arrived, the steam-valve, F, is shut, to prevent the farther admission of steam from the boiler; and at the same instance, the exhausting-valve, K, being opened, the steam from the top of the cylinder passes off to the condenser, and this makes a vacuum above the piston, the same as was before made beneath it: in consequence, the piston is left at full liberty to rise by the action of the counter-weight, until it arrives at the top: the exhausting-valve, K, is then shut, and the steam-valve, F, opened, to make a fresh descent. The advantage of this contrivance is, that the whole time, during which the ascent of the piston is allowed for making the condensation; but this is found of little importance in practice, because the vacuum takes place almost instantaneously, when the exhausting-valve is opened, to allow the steam to pass off to the condenser.

Mr. Watt's Expansion-Engine.—This was a most important improvement, of which Mr. Watt had the first idea in 1769, but did not fully put it in practice until 1778. It consists in shutting off the farther entrance of steam from the boiler, when the piston has been pressed down in the cylinder for a certain proportion of its total descent, and then leaving the remainder of the descent to be accomplished by the expansive force of that steam which is already introduced into the cylinder. This gives the means of regulating the acting force of the engine, because the pins of the plug-frame can be placed in such a manner, as that the steam-valve shall be shut when the piston has descended one-half, one-third, one-fourth, or any other proportion; and so far the cylinder will be occupied with steam of the same elasticity as that in the boiler, which is usually about the same as the atmosphere. In order to press the piston farther down, the steam must expand; and though its elasticity will diminish, it will be enough to complete the stroke. It is plain that this can be done in any degree at pleasure, as the adjustment of the pins in the plug-frame can be varied in an instant; and according as the engine requires more or less power, to allow the steam to act with its full force upon the piston for a greater or less portion of its total descent. If this method of working an engine had no other advantage than the regulation of the power, it would not effect the end better than the throttle-valve; but by the expansive principle a great saving of steam is made. We have before observed, in describing the action of Newcomen's engine, that the motion of the piston is accelerated in its descent by the continued action of the pressure of the atmosphere whilst the load is constant, or even greatest at the first, considering the vis inertiae. Mr. Watt's engine is the same, but in a less degree, when it has a throttle-valve, because the steam cannot then come to the piston, except in a limited quantity; but when the top of the cylinder is open to the boiler, or the throttle-valve fully open, the effect is the same as if the atmospheric air had free entrance into the top of the cylinder. Now by stopping the further entrance of the steam at a certain portion of the descent, the piston can be made to descend with an uniform velocity, by the expenditure of only a portion of that quantity of steam which would be required, if steam of its full density was employed to press it down to the bottom with an accelerated velocity.

But when the steam is shut off at a portion of the descent, the pressure on the piston is continually diminishing as the descent becomes more and more rare; and, consequently, the accelerating force which works the engine diminishes. The motion of the descent, therefore, will no longer be uniformly accelerated; it will approach much faster to uniformity; or it may even be retarded; because, although the pressure on the piston at the beginning of the stroke may exceed the resistance of the load, yet when the piston is near the bottom, diminution of the pressure may occasion the resistance to exceed the pressure; in this case the motion can only be continued by the momentum of the moving parts. Whatever may be the law by which the pressure on the piston varies, it is possible to contrive the connecting machinery in such a way, that the chains or rods at the outer end of the beam shall continually exert the same pressure to lift the pump-rods, or that the machinery shall vary its resistance according to any law which is found most convenient. This may be done on the same principle that the watch-maker, by the form of the fusee, transmits an equal pressure to the wheel-work, from a very unequal action of the main-spring. In like manner, by making the communication from the piston-rod to the pump-rod by means of chains, which wind upon head-arches, formed to portions of a proper spiral instead of a circle, the force of the piston upon the beam and pump-rods can be regulated at pleasure, so as to produce an uniform effect.

This was the subject of Mr. Watt's patent, March 19, 1782, for certain improvements upon steam-engines, and certain new pieces of mechanism to be added to them. The specification of this patent, which is lodged in the Rolls chapel, states the invention to consist in shutting off the steam at a portion of the descent, as we have described, and applying combining levers, or other contrivances, so that the unequal or decreasing action of the steam upon the piston shall produce an uniform effect in raising the water in the pump-barrels.

The action of the expansion of the steam on the piston is thus explained. Suppose the whole descent of the piston diametrically divided, viz. into ten parts, and each subdivided, the varying pressure of the expanding steam on the surface of the piston at each division will be according to the following table.
table, which we have made out from the information given in Mr. Watt’s specification, and which is on the supposition that the cylinder is eight feet long, or an eight-feet stroke, and that the steam is shut off at one-fourth of the descent, or at two feet from the top; but the same law will hold generally as to these particulars. The pressure of the steam in the boiler is supposed to be equal to that of the atmosphere, or 14 lbs. per square inch, and the load of water in the pumps equal to 10 lbs. per square inch of the piston’s surface.

<table>
<thead>
<tr>
<th>Portions of the Defect from the Top of the Cylinder</th>
<th>Proportion of the Pressure of the Steam on the Piston in the whole Pressure of 14 lbs. per square inch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>.05</td>
<td>1. 1. 1.</td>
</tr>
<tr>
<td>.15</td>
<td>1.</td>
</tr>
<tr>
<td>.2</td>
<td>1.</td>
</tr>
<tr>
<td>.25</td>
<td>0.83</td>
</tr>
<tr>
<td>.3</td>
<td>0.714</td>
</tr>
<tr>
<td>.35</td>
<td>0.625</td>
</tr>
<tr>
<td>.4</td>
<td>0.555</td>
</tr>
<tr>
<td>.45</td>
<td>0.525</td>
</tr>
<tr>
<td>One-fourth, or</td>
<td>1.</td>
</tr>
<tr>
<td>.5</td>
<td>1. 0.83</td>
</tr>
<tr>
<td>.55</td>
<td>0.714</td>
</tr>
<tr>
<td>.6</td>
<td>0.625</td>
</tr>
<tr>
<td>.65</td>
<td>0.555</td>
</tr>
<tr>
<td>.7</td>
<td>1. 0.83</td>
</tr>
<tr>
<td>Supply of steam cut off, and the descent is produced by the expansion only</td>
<td>Or half the original pressure;</td>
</tr>
<tr>
<td>.75</td>
<td>0.525</td>
</tr>
<tr>
<td>Three-fourths, or</td>
<td>1. 0.525</td>
</tr>
<tr>
<td>.8</td>
<td>0.525</td>
</tr>
<tr>
<td>.85</td>
<td>0.525</td>
</tr>
<tr>
<td>.9</td>
<td>0.525</td>
</tr>
<tr>
<td>.95</td>
<td>0.525</td>
</tr>
<tr>
<td>Bottom of cylinder 1.</td>
<td>0.525</td>
</tr>
</tbody>
</table>

This is the full pressure of 14 lbs. per inch, before the supply of steam is shut off.

| Or one-third the original pressure; |
| .333                                 | Win. 4 1/2 lbs. per square inch. |
| .312                                 |                                                   0.375                                                                                 |
| .294                                 |                                                   0.375                                                                                 |
| .277                                 |                                                   0.375                                                                                 |
| .202                                 |                                                   0.375                                                                                 |
| .25                                  |                                                   0.375                                                                                 |

Thus, let the diameter of the piston be 24 inches, and the pressure of the atmosphere on a square inch be 14 pounds, the pressure on the piston is 6333 pounds. Let the whole stroke be 6 feet, and let the steam be stopped when the piston has descended 18 inches, or 1.5 foot. The hyperbolic logarithm of 6 is 1.3862943; therefore, the accumulated pressure $\CrF\ell\IC$ is $6333 \times 1.3862943 = 15114$ pounds.

As few professional engineers are possessed of a table of hyperbolic logarithms, while tables of common logarithms are or should be in the hands of every person who is much engaged in mechanical calculations, let the following method be practised: Take the common logarithm of $\IC$ and multiply it by 2.3026, the product is the hyperbolic logarithm of $\IC$. The accumulated pressure, while the piston moves from $\Cr$ to $\EF$, is 6333 x 1, or simply 6333 pounds; therefore, the steam, while it expands into the whole cylinder, adds a pressure of 8781 pounds. Suppose
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Suppose that the steam had been freely admitted during the whole deficit of the piston, the accumulated pressure would have been 533.10, or 15,332 pounds. Here Mr. Watt observed a remarkable result. The steam expended, in this case, would have been four times greater than when it was stopped at one-fourth, and yet the accumulated pressure is not twice as great, being nearly five-thirds. One-fourth of the steam performs nearly three-fifths of the work; and an equal quantity performs more than twice as much work, when thus admitted, during one-fourth of the motion.

This information is curious and important, and the advantage of this method of working a steam-engine increases in proportion as the steam is sooner stopped; but the increase is not great, after the steam is rared four times, as the curve then approaches near to the axis, and small additions are made to the area. The expense of such great cylinders is considerable, and may sometimes compensate this advantage.

Let the Steam be stopped at its Performance is multiplied

\[ \begin{array}{ccc}
\text{\( \frac{1}{4} \)} & & 1.7 \\
\text{\( \frac{1}{2} \)} & & 2.1 \\
\text{\( \frac{3}{4} \)} & & 2.4 \\
\text{\( \text{Full} \)} & & 2.6 \\
\text{\( \text{Full} \)} & & 2.8 \\
\text{\( \text{Full} \)} & & 3.0 \\
\text{\( \text{Full} \)} & & 3.2 \\
\end{array} \]

The advantages of the expansive method of working an engine are more fully obtained, when steam of an elastic pressure considerably greater than the atmosphere is employed. The second table of expansion shows, that the increase of the force of steam, heated much above the boiling point, is very great by a small increase of heat. For instance, at 212°, the steam is equal to the atmosphere; by only increasing the heat 40°, viz., to about 252°, we obtain a double pressure, or two atmospheres; and the farther increase of 30°, viz., to about 282°, makes an additional force, which renders it equal to three atmospheres. Again, 24° higher, or about 306°, makes the steam equal to four atmospheres; and if it were practicable to go much farther, probably the same law would hold. Now it follows as a consequence, that if such small accretions of heat produce so rapid an increase of the expansive force, small abstractions of heat from highly expansive steam will also reduce its expansibility in an equal degree, so that steam highly heated is more readily diminished in bulk by the application of cold than weaker steam; that is, it can be more readily reduced in its pressure to any certain proportion of the pressure it had before. But if we would take away all its pressure, and leave a vacuum, we must apply a sufficiency of cold water to take away all its heat, which is greater than weaker steam, though not in direct proportion to its elastic force.

Mr. Watt's first specification (1769) describes the method of working by cooling or reducing the force of the steam, without wholly condensing it; but it has always been found most advantageous to condense effectually, even though the power necessary to draw out the injection-water from the condenser is considerable; the engine, in consequence of the greater perfection of the vacuum, is well able to afford this deduction. The most advantageous application of highly heated steam is on Mr. Watt's principle of admitting it in its full power, for a small portion of the deficit of the piston; and then shutting off the supply, the remainder of the action is effected by the expansive force of that portion of steam already admitted. But to obtain the full advantage of the varying forces, it is necessary to have some contrivance, by which the effect of the engine, on the work which it is performing, shall be uniform, or nearly so. Mr. Watt's specification of 1782 contains a great number of different methods: first, by chains acting upon spirals, on the principle of the fuses; secondly, by levers acting unequally upon each other; thirdly, by a large weight attached to the working-beam, at a considerable height above the centre of motion. When the piston begins its descent, this weight will oppose itself to the motion of the piston, until the descent of the latter has inclined the beam so much, that the centre of gravity of the weight is perpendicularly over the centre of motion of the beam; the weight has then no effect on the engine; but after it has pulled this position, it must evidently tend to aid the effort of the piston to draw up the load of water in the pumps. And it is possible to adjust the weight in its position, quantity, and height above the centre of the beam, that it will very nearly equalize the diminishing force of the piston; but this must be when the beam is always stopped at the same proportion of the total descent.

Fourthly: Another method, which is very ingenious, is to have two large cylinders or pumps, open at top and bottom, and each furnished with a piston without valves. The pistons of the two are fulminated from the opposite ends of the beam, so that the deficit of one will produce the ascent of the other. The cylinders are filled with water, which is conducted by a large trough from the top of one cylinder to the top of the other, so that the water is alternately transferred from one to the other. Suppose each piston at the middle of its respective cylinder, the water will be equally divided between them upon their pistons, and will hang in equilibrio on the beam; but suppose one end of the beam depressed, the piston fulminated from the opposite end will rise and raise up part of the water, which rests upon it, into the trough, by which it will run into the opposite cylinder, and as the corresponding deficit of that piston has made room for it, the water becomes unequally divided. When one piston is at the top of its cylinder, the other will be at the bottom, and have the whole of the water resting upon it. Suppose this piston to be that which is at the outer end of the beam, the steam-piston will be at the top of the cylinder; then if steam be admitted, it will press down the steam-piston, and draw up the water in the cylinder at the outer end of the beam. The weight of this water opposes the motion of the steam-piston, because the whole of the water in the water-cylinder must be lifted; but by the time the steam-piston has descended one-third or one-fourth, and the steam is shut off, the pressure on the steam-piston begins to diminish. The weight of the water on the water-piston has diminished also, because part of the water in it has run off by the trough, and entered into the opposite cylinder, where its weight upon the water-piston tends to aid the steam-piston in descending; and this aid continues to increase as the steam-piston descends farther, by the water being regularly transferred from the ascending to the descending water-piston; until the whole of it rests upon that piston which is at the bottom of its stroke. It is evident that the same action must take place in returning, and therefore this contrivance is only applicable to a double acting engine, and such engines are not commonly used for pumping water.

The application of any of these ingenious contrivances to the vaid engines employed in pumping would be attended with great difficulties; and if attempted to be used to equalize the action of the expansive principle, when applied
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plied to its fullest extent, would, we think, be impracticable: we mean, when steam of great elastic force is employed, and when the floppage of the supply is made to take place at a very small portion of the deficient. In this case, the strain upon the centres of the shafts or levers, sufficiently oblique to equalize the action, would be beyond all bounds. Lord Stanhope has applied the principle of Mr. Watt's levers, in the most judicious manner, to the printing-prefs. (See Part II.) It is in so small a machine, worked only by the strength of one man, the firmest cast-iron frame of the press has been frequently broken.

We suppose it is for such reasons, that Messrs. Boulton and Watt have not, that we know of, applied these contrivances to any of their engines, but have contented themselves with employing a steam a little more than the preface of the atmosphere, and stopping the supply at one-fourth or one-third of the deficient, according to the circumstances under which the engine works. In this case, the decreasing preface in a large engine is not much greater than to counteract the acceleration, and aided by the moment of the heavy working beam, pump-rods, and rising column of water, produces nearly uniform motion.

Mr. Hornblower, about 1781, had a patent for a method of applying the expansive principle of Mr. Watt in two successive cylinders in such a manner, as to approach more nearly to an equality of force, by which steam of great preface can be employed to act by its expansion. This kind of engine, of which a description is to be found in Mr. Watt's specification of 1782, has since been brought to a great degree of perfection by Mr. Woolf, as we shall notice.

Description of Messrs. Watt and Boulton's complete Single Engine.—Plate III. fig. 1. is taken from the engine at Chelsea water-works, for pumping water for the supply of London: it was erected in 1804, and is estimated at fifty horses' power. We have hitherto considered Mr. Watt's engine as being fitted up with the great wooden beam, and arch-heads, chains, and pumps, the same as the old engine. This was the form of the engine for some years; but since 1804, when Mr. Watt invented the parallel motion for his double acting engine for turning mills, that ingenious contrivance has been applied to the pumping engines, instead of the arch-head and chains, as being more correct in its action. Also, for about fifteen years past, they have employed cast-iron working beams instead of wood. A B C is the beam, which is made of cast-iron instead of wood, and is composed of two large plates, of the shape represented in the figure, put together at twelve inches distance from each other, leaving a space between them, the centre or axis B passing through the middle of both plates. The axis lies on the floor D, which is sustained by the wall E, built beneath the centre. Q is the cylinder, contained within a steam-jacket, composed of segments screwed together. F is the steam-pipe coming from the boiler G. a b is the piston-rod, connected with the end, C, of the beam by links a, b; and whilst the upper ends of these links move in the arc of a circle, with the end of the beam, the lower ends, b, are made to accommodate themselves to the vertical motion of the piston-rod a, by means of the rods, c, extending to the smaller links, d, which form a parallelogram. The motion of the parallelogram is governed by the bridle-rods, which move about a fixed centre m. The action of this contrivance is fully explained under the article Parallel Motion; and it is enough for our present purpose to understand, that the lower ends, b, of the links, b, c, will ascend and descend in a perpendicular right line. A similar motion, but of half the quantity, is given to the rod, R, which works the air-pump, N, of the engine at the lower end, and the middle part of the rod has the plunger, R, attached to it, which has pins, or chocks, screwed on it to actuate the handles, x y, and z, of the mechanism for the valves, which mechanism is very different from that employed in the old engines, and even from that of the first engines of Mr. Watt. But to describe all the varieties which have been adopted, would occupy a volume, and afford information of but little value.

The pump-rod, p, is connected at the end, A, of the beam by another parallel motion, and the upper part, S, of the rod is made of cast-iron, and very massive, to have a sufficient weight in itself to draw up the piston, and make the return-stroke. The real pump-rod, p, is joined to the heavy counter-weight S, and is polished, like the piston-rod a, that it may slide through a collar of leathers in the head of the pump Y, because the pump is of that kind called lifting-force-pumps; its bucket raises the water in ascending, but it forces it through the air-reel T, and pipe X, which leads to a reservoir two miles distant in Hyde Park, and elevated 150 feet above the level of the water in the well where the pump draws from. This well has a communication with the river.

The cylinder, Q, is kept down by the weight of a pillar of masonry, on which it is placed, and large iron bolts, u, descend from the lower flank to the groundfells, upon which the masonry is built. Immediately before the pier is the condensing cistern, M, which contains the air-pump N, the condenser L, partly concealed, and hot-well g, and is kept supplied with cold water by the cold-water pump I, worked by the beam at the outer end, and the waffe runs off again into the well, so as to keep the water in the cistern always cold.

The valves, which must be opened and shut to produce the action of the engine, are four in number; viz. the upper steam-valve at F, the lower steam-valve O, and the exhaust-valve K, and a small valve l, beneath the water in the cistern M, to admit the injection into the condenser; but these parts are better explained in fig. 2, which is a section of the cylinder, air-pump, and condenser on a double scale.

A is the section of the cylinder, in which the piston, X, moves; F is the steam-pipe coming from the boiler; L, the condenser; N, the air or discharging-pump; m, a passage or pipe from the pump to the condenser, in which passage an occasional communication by a hanging-valve at m, which flushes towards the condenser; I is the injection-valve, to be lifted by the engine at every stroke, for the purpose of condensing the steam in the condenser L; w is the snorting or blowing-valve, placed outside the condensing cistern (of which MM is a section, on purpose to shew the contents); the snorting-valve, w, communicates with the condenser by a pipe passing through the side of the cistern M, and is inserted at the side of the condenser; K is the exhaust-valve, to be lifted by the engine, and open a communication between the cylinder A and the condenser L; O is the steam-valve, to be lifted by the engine, and open a communication between the lower part of the cylinder, and upper part thereof, through the steam-pipe r; and F is the upper steam-valve of the same kind, opening a passage from the boiler to the top of the cylinder; and thence by the pipe r, and valves O, K, to all parts of the engine.

We must now attend to the mechanism by which the engine is made to feed itself, and perform its reciprocations. The valves are lifted by means of a lever applied to each, within the iron box in which it is contained, entering into an opening in the stem of the valve; and a second lever is fixed on the axis of the lever, on the outside of the box, to be connected with
with the levers and handles, $x$, $y$, $z$, which open and shut the valves. There are three separate axles, or spindles, placed parallel and above one another, and each has a handle or spanner, $s$, $y$, $z$, by which it is moved, either by the hand, to start the engine, or by the clock on the plug-beam $R$, when the engine is in action. The two upper spindles, $x$ and $y$, have short levers projecting from them towards the cylinder; and from each of these levers a rod is suspended, with a sufficient weight, $w$, at the lower end to turn round the spindle, each upon its axis, in the direction which will cause the handles, $x$ and $y$, to fly upwards. Also the lower spindle has a lever projecting from it, away from the cylinder, with a heavy weight, $n$, fixed at the end; but this being applied, on the opposite side, to the weights of the two upper handles, $x$, $y$, the weight, $n$, causes the handle, $n$, to descend. Both the axles of the lower handles, $x$, $y$, have small levers, or catches, $t$ and $s$, which act in the hooks of a double latch, or detent, $t$s, which is moveable upon a centre-pin situated between the two axles. The hooks of this detent are to detain the catches of the spindles, and prevent them $x$, $y$, from moving by the action of their respective weights, until the detent is moved upon its centre, so as to relieve the catches of the levers from its hooks, $s$, $t$. But it is evident, from fig. $A$, that when only one catch, $t$, is hooked by the lower hook, $s$, of the detent, and consequently the weight of the spindle is held up, if the other catch, $s$, is moved by depressing its handle, $x$, so as to pull down the weight in the act of entering the hook, $s$, of the detent, it will press the end, $t$, of the detent forwards upon its centre, and this at the same time pressing back the hook, $s$, at the opposite end of the detent, releases the catch, $s$, of the lower handle, $x$, therewith, and the weight, $n$, on that spindle immediately falls.

The spindle of the upper handle, $x$, is devoted to opening and shutting the upper steam-valve $F$, having a lever which communicates by a rod, $x$, with the lever, $x$, of that valve; so that, by pressing down the handle, $x$, the valve is opened. The weight, $w$, which is applied to the upper spindle, tends to lift up the handle $x$, and open the valve $F$; and when the upper handle, $x$, is depressed, the valve will be shut; or when the handle is suffered to fly up by the action of its weight, it will open the valve.

The second spindle, $y$, has a lever communicating with the lever of the exhausting-valve $K$, by a rod $y$. The weight, $w$, applied to this like the former, tends to lift up the handle, $y$, and draw open the valve; but when the handle, $y$, is depressed, the valve is shut, and in this position the catch, $t$, is held down by the hook, $s$, of the detent before explained, and retains the valve shut.

Lastly, the lower spindle, $z$, is for the lower steam-valve $O$, which is opened by the rod $z$, when the handle, $z$, is suffered to fall down, and shut when the fame is up, being held by the catch, $s$, and hook, $w$. In all these the weight tends to open the valve; but when the valve is to be kept shut, the detent holds the weight up. Now, by removing the detent, the weight falls and opens the valve in an instant.

The upper spindle has no detent to detain it; but what is wanted by it is $s$ to be jointed to the other spindle, axis which has its weight and rod, $s$, suspended from it. The upper end of the rod, $s$, is made with a loop, or long slit, in which works $s$ pin at the end of a lever, $s$, projecting from the upper axis towards the cylinder. The consequence of this is, that while the middle axis is detained by its catch, and detent $s$, to keep the exhausting-valve, $K$, shut; the lever, $s$, of the upper spindle will be borne up by its pin resting in the bottom of the loop of the rod, $s$.

So as to keep the weight from opening the upper steam-valve $F$, as long as the exhausting-valve is kept shut; but when the catch, $t$, of the middle axis is discharged, and its weight has opened the exhausting-valve, the looped rod, $s$, will no longer support the lever, $s$, of the upper axis, but allows its weight to descend and open the upper steam-valve; but at the same time the upper steam-valve, $F$, is not confined to be always open when the exhausting-valve, $K$, is open; for the upper steam-valve may be shut by depressing the upper handle, $x$, without affecting the exhausting-valve at all, because the slit, or loop, in the top of the rod, $y$, allows that motion. This property must be attended to, because the action of the engine, by expansion, depends upon it. We have not before noticed the injection-valve, from which a long wire ascends, and is attached to a strap, $y$, which winds upon the middle axis; therefore, when the middle handle, $y$, flies up by its weight, it winds the strap, and opens the injection-valve at the same instant that the exhausting-valve is opened.

The injection-valve, $s$, is placed to close the orifice at the end of a short curved pipe, which enters into the condenser and turns up; and the pipe has a cock in it, between the valve and the condenser, to cut off the communication, or to regulate the supply of injection when the valve is opened. This cock must be always shut when the engine is not at work, to prevent the condenser filling with water.

**Operation of the Engine.**—We will now consider the action of the engine. Suppose the fire lighted beneath the boiler $G$; all the valves are kept shut by pressing down the two upper handles, $x$ and $y$, and lifting up the lower one, their respective catches detaining them in those positions, until the steam is sufficiently heated, and the engine is ready to work. In the quietest position of the engine, when it is at rest, the counter-weight always draws the piston fully at the top of its cylinder, as in the figure; the air-pump bucket will also be at the top of its barrel.

In order to prepare for setting the engine to work, all the three valves must be opened at once. This is done by relieving the spindles from their several catches, when the weights immediately open the valves. The steam enters through the valve $F$, into the top of the cylinder, and by the pipe, $s$, through the lower steam-valve, $O$, into the bottom of the cylinder; also through the exhausting-valve $K$, into the condenser $L$, driving before it some air, which passes out at the snuffing-valve, $w$. At first, the coldness of the parts cools the steam which enters; and it is not until all the iron, with which the steam comes in contact, is heated to the temperature of boiling water, that the steam ceases to flow from the boiler in a steam, and is condensed as it arrives at the cylinder and condenser; but after this, the steam acquires the same force in the cylinder and pipes that it has in the boiler: it then occupies every cavity and crevice of the engine, and in a little while displaces all the air in the cylinder, condenser, and pipes, which passes out, and is discharged at the snuffing-valve, $w$. This valve is always covered with water in a small cistern attached to the side of the large one, to ensure its tightness. Through this valve the air is discharged by the steam, not at every stroke, as in Newcomen's engine, but only at first setting the engine to work, and this operation is called the blowing through. It is well known when the cylinder and other vessels are properly heated, and the air discharged, by a very smart cracking noise at that valve, like a violent decrepitation of fault in the fire; this noise being occasioned by the water in the small cistern producing a sudden and rapid condensation of the issuing steam when the air is all gone.
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It is being known by this sign that all parts of the engine are cleared of air, all the three valves are to be shut, by pressing and holding down the two upper handles $x, y$, and lifting up the lower handle $z$, in which situation its catch, 2, will retain it. This cuts off the farther supply of steam from the boiler, and also intercepts the passage of the steam from the cylinder to the condenser; and as the cold surface of the condenser still continues to condense a considerable portion of steam, there will soon be none left, and a vacuum will be formed in the condenser, while the cylinder both above and below the piston is full of steam. The vacuum in the condenser will soon become perfect from the external cold alone, though more slowly than when an injection is made.

In this state the engine is prepared for starting at a moment's notice, by the engine-man letting the two upper handles, $x$ and $y$, rise up, by their respective weights: this opens the upper steam-valve, and the exhausting and injection-valves; the former admits the steam into the top of the cylinder, to press upon the piston; while the latter allows the steam, already in the lower part of the cylinder, to flow into the vacuous condenser; and at the same instant that he opens the exhausting-valve, the valve is shut at the same time, by which the admission of the steam is cut off, and the cylinder is emptied of steam. This allows cold water to pass through the condenser, and condenses the steam as fast as it arrives from the cylinder, so that in an instant all the steam in the lower part of the cylinder will be drawn off and condensed. The preasure of the steam on the piston being now unbalanced by any thing beneath the piston, it descends and draws up the pump-bucket, and columns of water in the pumps, with a velocity proportioned to the preasure of the steam, and the diameter of the piston, compared with the height of the column of water in the pump, and the diameter of the steam to the boiler: but the piston having descended about one-third of its stroke, a check of the plug-frame, $R$, meets the upper handle $x$, and presses it down, shutting off the steam from the boiler. That part of the handle on which the check acts becomes perpendicular when the valve is shut, the handle being bent for that purpose; and the check can therefore descend farther, and slide against the perpendicular part of the handle, which is straighth, without producing any farther depression of the handle, at the same time that it keeps it down to the same point, so as to hold the valve shut. The piston, therefore, continues its descent by the further expansion of the quantity of steam at first let into the cylinder; but having arrived at the bottom of its stroke, a check on the opposite side of the plug-frame, $R$, seizes the middle handle, $y$, and presses it down, which pulls the rod, 4, until it shuts the exhausting-valve, $K$, and also shuts the injection-valve by the strap and rod 9. When the catch, 1, of this handle, $y$, presses on the upper hook, 4, of the detent 10, it relieves the catch, 3, of the lower axle $z$, and then the weight, $z$, causes the handle, $z$, to fall, and pulling the rod 14, opens the lower steam-valve, 0. Let us now consider the position of the engine: the middle handle, $y$, being held down by its catch, 1, holding in the upper hook, 4, of the detent, so as to keep the exhausting-valve, $K$, shut, and the upper steam-valve, $F$, is also kept shut, by the same means which kept it shut during the latter two-thirds of the descent of the piston.

Under these circumstances the piston is at liberty to rise by the action of the counter-weight $S$, because the opening of the lower steam-valve, $O$, has established a free communication between the top and bottom of the cylinder, and the steam in the top of the cylinder can flow freely to the valve $z$, and enter the bottom of the cylinder, as fast as the piston rises, by the action of the counter-weight.

When the piston has returned to within one-third of the top of the cylinder, the check of the plug-frame quits the upper handle $x$; but this handle cannot yet be thrown up by its weight to open the upper valve, because the rod, 5, from the lever of the middle axis bears up the short lever, 6, of the upper axis $x$; and thus the motion continues, till the piston arrives very nearly at the top of the cylinder: a check on the plug-frame then seizes the lower handle $z$, and lifting it up, shuts the lower steam-valve; and the catch, 2, of the lower axis pulling the lower hook, 9, of the detent, moves it on its centre, so as to release the catch, 1, of the middle axis from the upper hook, 4, of the detent. This being the case, the weight of the middle axis carries its handle, 4, to, up, and by the rod, 4, it opens the exhausting-valve; and by drawing the strap and rod, 9, it opens the injection-valve; at the same time the upper axis, $x$, losing the support of the rod 5, which kept it up, its weight carries up the upper handle $x$, and by pulling the rod, 2, it opens the upper steam-valve, $F$.

The steam from the boiler is now admitted to press upon the upper surface of the piston, while the steam from the lower part of the cylinder behind the piston rushes into the condenser, where being met with the cold injection, it is condensed, and makes a vacuum in the lower part of the cylinder, which brings down the piston to make another stroke.

At one-third of the descent, the plug-frame, as before, presses and holds down the upper handle $x$, to keep the upper steam-valve shut; and when the piston has arrived at the bottom, the plug-frame presses down the middle handle $y$, to shut the injection and the exhausting-valves; and in catching, this discharges the lower axis, and the weight thereof opens the lower steam-valve. The piston then rises by the counter-weight, and when at the top of its stroke, the plug-frame lifts the lower handle $z$, and shuts the lower steam-valve; and in catching, this lifts the two other handles, which open the upper steam-valve, the exhausting-valve, and the injection-valve, and this produces the descent of the piston, as before.

If the air has been fully discharged from all parts of the engine by blowing through, the action of the air-pump does not begin until the injection-water and the air, which are extricated from the water in the boiling, have accumulated in some quantity in the condenser; then at every descent of the bucket, $d$, of the air-pump, it dips into the barrel of water contained in the bottom of the barrel $N$, and the water passes through the valves in the bucket, and then the valves shut when the bucket is drawn up, lifting all that water which is above them up to the top of the barrel, and there it is forced out through the hanging-valve, $g$, into the hot-well $G$. The drawing up of the bucket at the same time makes a vacuum in the pump-barrel beneath it; and if this vacuum is more perfect than that in the condenser, which it will be, if the condenser contains either air or steam, it will press by its elaticity upon the surface of the water in the lower part of the condenser, and force it through the hanging-valve at $m$, into the lower part of the barrel, $N$, of the air-pump; and when all the water is gone from the condenser, the air or elastic vapour which is in the condenser will follow and enter into the pump, until the space of the barrel beneath the bucket is filled equally with the condenser.

This takes place while the pump-bucket is at the top or its barrel; and on the descent of the bucket, the space beneath it is diminished, until it compresses this rarefied vapour so much, that its elaticity will be sufficient to close the hanging-valve, $m$, and to lift the valves in the bucket, $d$, and pass through them into the space of the barrel above the bucket: and when the bucket has descended to the very lowest, the water contained in the bottom of the barrel, not being able to escape through $m$, must pass up through the valves, and rest upon the bucket $d$. When the bucket ascends, it carries
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before it this water and air, and as it rises the space of the barrel above the bucket diminishes, and the rare vapour or air in it condenses by being crowded into less space, until at last it becomes equally dense with the atmospheric air, and then the water following it, drives through the valve, \( g \), into the open air.

The descent of the bucket, \( d \), left a vacuum beneath it, as before, and this drew a portion of the air or vapour from the condenser into it, ready to be extracted by the next stroke. As soon as the bucket begins to return, the discharge-valve, \( g \), shuts, and prevents the atmospheric air from entering into the pump. By this we see, that if the vapour in the condenser is so rare that the whole contents of the barrel of the pump will only make a few cubic inches, when reduced to become equal to the pressure of the atmosphere, this small quantity will be effectively evacuated through the discharge-valve, \( g \), because the water reffing upon the bucket follows the air, and will chase every particle of it from the top of the pump, and then follow itself.

The air-pump of Mr. Watt's engine requires to be of large dimensions, and the condenser is generally of the same size, by which means the rarefaction of any elastic vapour contained in the condenser will be equal to half at every stroke; that is, the air-pump will extract half the quantity of the elastic vapour every time; because, supposing the vacuous space which the bucket of the pump leaves beneath it, when it is drawn up, to be equal to the capacity of the condenser, then the vapour in the condenser must expand itself to fill a double space, by which one half of it will enter into the pump, and be drawn out by the succeeding stroke, while the other half will remain in the condenser.

The cylinder at Chelsea is four feet diameter, and eight feet stroke, and the air-pump two feet diameter, and four feet stroke; thus, their areas respectively are as one to four, and their capacities as one to eight. But it must not be considered that this large pump, full of air, is to be drawn out of the condenser at every stroke; for, as we have stated before, the vapour with which it is filled reduces itself to a small quantity before it comes to the density of atmospheric air. At first sight we should be led to conclude, that the pump affects the power of the engine, as a deduction, of as much power as the pressure of the air upon the surface of its bucket; but if we consider its contraction, having a valve at \( g \) to keep off the pressure of the atmosphere, it is certain its bucket can have light weight upon the engine, until the bucket is near the highest height of the stroke; and taking the sum of the resistance, from the commencement of the stroke to its termination, it will be found to be very little in comparison with the power of the cylinder.

An air-pump of one-eighth the capacity of the cylinder is sufficient to keep the condenser empty when it is a single engine. If a smaller air-pump were employed, it must be in action to lift out the air and water, for a greater portion of its stroke.

In fact, whatever the size of the air-pump may be, it will occasion little more resistance to the engine than from the friction of its bucket, except during the time that it has actually opened the valve, \( g \), to discharge the air or water which it contains; before that period, the resistance is only that of condensing the vapour, an operation which begins at nothing, but increases by an ascending proportion reverse to that of the decrease of the pressure of the steam, when acting in the cylinder by expansion, as we have before explained.

In Mr. Watt's early engines, the air-pump and condensing cistern were placed at the outer end of the beam; and there are some reasons to prefer that mode of construction, where the building will admit of it. In this case, the pump-bucket being drawn up by the descent of the piston, the engine requires a less counter-weight than in the form just described, in which the air-pump must be wholly worked by the counter-weight. Alto, it is during the descent of the piston that the action of the air-pump is most necessary; and it is possible that an engine, having the pump worked by the outer end of the beam, may make a better vacuum than when it is worked by the inner end, because there may be some, though a very slight impulse given to the remaining air of the last stroke, by the rush of steam into the condenser at the infant the steam-piston begins to descend, and the air-pump to rise; for no sooner is the exhausting-valve opened, than the steam rushes towards the condenser, and giving a momentary tendency to a plenum therein, may give a pull to the air through the hanging-valve, between the pump and the condenser; and hence it is reasable to conclude that more air will enter the pump by this means, than if it were left to its own expansion.

It is necessary that the parts appropriated to the condensation of steam should be kept as cold as possible, and those intended for the operation, or passage of the steam, as hot as possible; hence the air or discharging pump and condenser are placed in the cistern of cold water, which is kept constantly full by the cold-water pump, and a little running away into the well, to carry off the excess of heat; and if the injection-valve is placed low in this cistern, it will take the water in the coldest state. The injection-valve and cock are shown in fig. 2.

As the condensing apparatus is immersed in water, to be kept cold, so the cylinder should, if possible, be immersed in steam, to be kept hot; for which purpose, Mr. Watt from the first used a casing or jacket round the cylinder, and also at the top and bottom: this was attended with very beneficial effects, although it enlarged the steam surface, and exposed the external jacket to a more rapid condensation than would have taken place from the surface of the cylinder itself. But to have the vacuum as perfect as possible, it is necessary that the cylinder be kept up to such a temperature, as to prevent the least condensation of the steam upon the internal surface, either above or below the piston; because, if the fides of the cylinder were to be wet, as in the common atmospheric engine, the vacuum would be vitiated, as there would be occasioned by this moisture a moiture gradually forming to steam, which the outside casing prevents, when filled with steam from the boiler, and the heat which escapes from the surface of the jacket does not injure the operation of the engine; but if it were possible to cover this outward case again with any sort of substance which would entirely prevent the transmission of heat from the casing, it would supercede the use of the jacket altogether, and would apply with more advantage to the cylinder itself; but we do not know of any substance which will not admit this transmission more or less. Some of Meffrin, Watt and Boulton's best engines we have seen surrounded by a case of polished copper, we believe outside of the jacket.

In small engines, it is common to place the cylinder within the boiler, and it must then be kept partly as hot as the steam which enters it; but this is not practicable in a large engine, nor is it advisable in any case, because the frequent repairs which the boiler requires must damage all parts of the engine.

When the jacket is used, a small copper pipe is conducted from the steam-pipe to keep it full. As the jacket of a large cylinder must be exposed to be heated or cooled less than the metal cylinder to which it is attached, the unequal expansion might break the joints; to avoid this, the jacket is made in two halves, put together in the middle of the
the length, without any other attachment than that of entering into each other for three or four inches, with a cup which is packed with hemp and tallow. The steam-pipe has a similar joint at $b$, fig. 2, which unites it to the box of the exhausting-valve $K$, and will admit of drawing out a little.

**Description of other parts of Mr. Watt's Engine.** In the drawing (fig. 1.) in our plate, the condenser is represented at one side of the air-pump, in which situation it partly conceals the pump. In fig. 2, they are put into a different position for explanation, the condenser being represented beneath the cylinder. The eudiotion-valve is carried sideways from the box in which the eudiotion-valve is situated, so that the condenser can be placed in any situation which is convenient.

13, 13, are the catch-pins, which are firmly fixed to each end of the beam, and limit the motion of the engine by coming down to strike upon the beams of the floor $D$, if the engine makes too long a stroke; and pieces of cork are laid on the floor to soften the blow with which it would otherwise strike. It once happened to this engine, that the valve of the pump-bucket breaking, the engine suddenly loit its load, or reformation, which occasioned the piston to descend, and strike on the spring-beams, or floor $D$, for two or three successive strokes, with such violence as to break one of the beams; and as lift the piston striking the bottom of the cylinder, the momentum of the beam forced down upon the rod for violently, as to bend the great piston-rod quite crooked. To prevent such accidents, a smaller steam-pipe was added at the side of the vertical steam-pipe, communicating with the passage into the outer cylinder; this pipe is kept closed by a valve; but if the engine descends so low as to strike on the spring-beam $D$, the catch-pin, 13, of the beam strikes a small lever 10, and by the communication wire, 11, opens the valve, and lets the steam into the lower part of the cylinder beneath the piston, and this destroys the vacuum, so as to prevent the farther descent of the piston.

There is a small spring-catch or detent, which tends to spring under the lever of the upper steam-valve, and prevent it from descending. This catch is held back by a second catch, which is relieved when the catch-pin strikes the lever 10, and then the first-mentioned detent, by retaining the steam-valve from being opened, prevents any danger of the engine making a repetition of the stroke while it has no load.

**Boiler.**—The boiler of the engine we have not mentioned before; it is set in a furnace, so as to receive the heat of the fire, and the flame passes through a long flue, which goes twice round the bottom part of the boiler, to give as much as possible of its heat to the water before it enters into the chimney. The steam-pipe, $F$, has a throttle-valve in it at 30, which regulates the supply of steam to the cylinder. This valve is not a conical spindle-valve, the same as the other valves of the engine, but is a circular plate of metal, made to fit the bore of the pipe, and is moveable upon an axis, which passes diametrically across the plate; and the end of the axis, where it comes to the outside, has a lever fixed on it to communicate motion to the valve, which being turned endways in the pipe, prevents scarcely any malignance to the passage of the steam; but when turned flat across the pipe, it flops its bore; and although it is not fitted with an extraordinary care, it is sufficient to regulate the steam. This kind of throttle-valve is preferable, because it can be moved by a very slight force.

**Regulator.**—There is a contrivance to regulate the velocity of the engine, by a small pipe proceeding from the air-valve of the pump; it conveys water to the lower part of a small vertical cylinder, into which a piston is fitted, and loaded with a heavy weight; then if the engine works too fast, so as to force more water into the air-valve than the main pipes, $K$, will carry off, it must make a greater preasure and condensation of the air in the air-valve, until the water is forced to run quicker through the main-pipe, and thus the preasure being also communicated by the small pipe to the regulating cylinder before-mentioned, causes its piston to lift the weight and rise up, and this motion is communicated by a wire to the throttle-valve, so as to close it and diminish the supply of steam; or, on the other hand, if the engine works too slow, the preasure in the air-valve must diminish, and then the loaded piston will sink and open the throttle-valve a small quantity, to admit more steam.

It should have been mentioned before, that the weight with which the piston of this regulating cylinder is loaded, is so contriv'd that it will increase in force as the piston ascends, and diminishs as it descends. There are many ways of doing this, but the one adopted, in this case, is to load the piston with a very heavy cast-iron chain, some of the links of which fall upon the ground as it descends, and relieve the piston from their weight; but as it ascends, it lifts other links off the ground, and becomes more loaded, until it finds itself a place where the load will balance the preasure of the water in the air-valve.

It is evident that, by this contrivance, the motion of the engine will at all times be so regulated, as to supply just the quantity of water desired; but these quantities can be made greater or less, by applying a greater or less weight to the piston, so that it will sink more or less into its cylinder, before it will come to an equilibrium with the preasure in the air-valve, and will thus open the throttle-valve more or less. But when the adjustment is once made, it will keep the engine working with regularity at that velocity.

In some of the latest engines erected by Mefira. Watt and Boulton, they have, by an ingenious movement, made the motion of this regulating piston communicate with a long screw, attached to the plug-beam, which regulates the chuck that flushes the upper steam-valve at any required portion of the descent of the piston. By this means, although the screw is in constant motion with the plug-beam, the screw is turned so as to regulate the chuck on the plug, and measure out the quantity of steam which the engine shall have introduced into the cylinder at each stroke, to enable it to fulfil its task.

It is in these properties of the engine, by which it regulates itself, and provides for all its wants, that the great beauties of the invention consist. M. Belidor, 80 years ago, speaking of the old engine, says: "It must be acknowledged, that this is the most wonderful of all machines, and that nothing of the works of man approaches so near to animal life. Heat is the principle of its movement: there is in it a tube circulation, like that of the blood in the veins of animals; having valves which open and shut in proper periods, it feeds itself, evacuates such portions of its food as are useless, and draws from its own labours all which is necessary to its own subsistence." To pursue the idea, we may now lay of the more perfect machine, that it has what approaches the appetite of animals, in taking that kind and quantity of food which its exigencies require, and in rejecting that which is unnecessary. But we must explain these self-regulators more fully.

**Apparatus connected with the Boiler.**—In order to know the exact height of the water in the boiler, two gauge-cocks are employed, one of which reaches to within a little of the height or level at which the water should stand, and another reaches a little below that level. If the water stands at the defired
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desired height, the first-mentioned cock, being opened, will give out steam; and the other cock will emit water, in consequence of the pressure of the superincumbent steam on the surface of the water. But if water should issue from both cocks, it will be too high in the boiler; and if steam issues from both, it will be too low. This is the same contrivance which was used in Newcomen's engine; but Mr. Watt applied in his first engine a small vertical glass tube, which has a communication with the boiler by a copper pipe cemented to each end: one pipe, from the top of the glass, enters the boiler above the intended level of the water; and the other pipe, from the bottom of the glass tube, enters the boiler below the surface of the water. In this way, it is evident that the glass tube will always be filled with water to the same level as the water in the boiler, and may be graduated with inches, to inform the engine-man when the boiler requires a supply.

Another contrivance is a pipe defending beneath the surface of the water in the boiler, when at its intended level; and in the upper end of the pipe at the top of the house a whistle or mouth-piece is formed; then, if the water in the boiler sinks too low, the steam will issue at the pipe, and, passing through the whistle, will make such a noise as to call the engine-man to his duty, even if he should have fallen asleep. This contrivance is rendered unnecessary by a subsequent one, by which the boiler will always feed itself, exactly as fast as its evaporation of steam requires.

The boiler is kept constantly supplied with water, to repair the waste of evaporation, by means of a small pump 20, which draws hot water from the hot-well 9, and raises it to such a height, that the water will run through a pipe, schemed by the dotted lines, into the cistern 14, placed over the top of the boiler, at an elevation of some feet. From this cistern a tube, 18, descends into the boiler, and terminates beneath the surface of the water therein, so as to feed the boiler with water. But as it is necessary that the water in the boiler should always be preferred at the same level, this feed-pipe is closed by a valve in the bottom of the cistern 14, which prevents the water running down into the boiler, until the level of the water subsides, and sheaves that it requires replenishing. A crooked arm, which is attached to the side of the small cistern 14, supports the short lever 15, 16, which moves upon a centre-pin. The extremity, 15, of this lever supports, by means of the wire 16, a flont or piece of metal, which hangs just below the surface of the water in the boiler. The wire passes through a small flapping-box in the top of the boiler, to prevent leakage. The other extremity, 15, of the lever is connected by a wire with a valve at the bottom of the cistern 14, which covers the top of the pipe 18; and this end of the lever is loaded with a sufficient weight to balance the flont in the boiler. Now it is a maxim in hydrostatics, that when a heavy body is suspended in a fluid, it loses as much of its weight as equals that of the quantity of fluid which it displaces. When the water in the boiler, therefore, is diminished, by the conversion of part of it into steam, the upper surface of the flont will be above the fluid, and its weight will consequently be increased in proportion to the quantity of its masts that is not immersed. By this addition to its weight, the flont will overcome the balance-weight on the end, 15, of the lever, causing the extremity, 16, of the lever to descend; and in consequence, by elevating the opposite arm 15, will open the valve at the top of the pipe 18, and thus gradually introduce a quantity of water into the boiler equal to that which is carried off by evaporation. This process is continually going on, while the water is converting into steam; and it is evident that too much water can never be introduced, for as soon as the surface of the water coincides with the surface of the flont, it recovers its former weight, and the valve at the bottom of the cistern, 14, shuts the top of the pipe 18, and prevents any more water entering the boiler, until the float or body, 21, descends by the diminution of the water therein.

When the engine is steadily at work, the flont subsides until it opens the valve to admit a regular stream of water, which will just equal the waste by evaporation; and then the operation will go on regularly, without any action of the float, until something is altered.

We have before stated, that the steam in the boiler is no stronger than the atmosphere; but there would still be great danger of the boiler's bursting, if the steam should accidentally become too strong: the boiler is, therefore, furnished with a safety-valve, which is so loaded, that its weight, added to that of the atmosphere, may exceed the pressure of the interior steam, when of a sufficient strength. As soon as the expansive force so far increases as to become dangerous to the boiler, its pressure preponderates over the pressure of the atmosphere, and the safety-valve is opened, when the steam escapes from the boiler, till its strength is sufficiently diminished; and the safety-valve shuts again, by the predominance of its pressure over that of the interior steam. By opening the safety-valve, the engine may be stopped at pleasure; and to effect this, a small rectangular lever, with equal arms, is fixed upon the side of the valve, and connected with its top. To one of these arms a chain is attached, which is conducted into the engine-houset, and palls over a pulley from a horizontal to a vertical direction, so that it hangs like a bell-pull. By pulling it, the valve is opened, and the machine is stopped.

There is also another valve of safety, for the receptor of the object of the first-mentioned safety-valve: it opens internally, and is balanced by a small lever, and a sufficient weight to keep it shut, until the pressure of the steam within the boiler becomes much less than the external air, which then forces open the valve, and enters into the boiler, till the equilibrium is restored. It is evident that this valve can never be necessary so long as the engine is at work; but its use is to prevent the sides of the boiler being crushed in by the weight of the air, when it has done work, and the steam within it cools and condenses.

Self-adjusting Damper.—By another ingenious contrivance, the boiler is made to regulate the heat of its furnace, in proportion to the quantity of steam which the cylinder draws off from it. For this purpose, a damper or iron sliding-door is fitted into the flue, just where it enters the chimney; and a chain is conducted from it, over pulleys, to any convenient situation, where the engine-man can pull it like a bell-pull, to draw up or lower down the damper, and by that means regulate the draught of air through the furnace, and the heat of the boiler.

To make the damper self-regulating, a large pipe of six or eight inches bore is fixed vertically through the top of the boiler: it is open at top and bottom, but the lower end descends nearly to the bottom of the boiler, so as to be always immersed beneath the surface of the water. Now the steam preying on the surface of the water in the boiler, and the atmosphere preying on the surface of the water in the open pipe, it is evident that the relative levels of the water in both will be at all times in exact proportion to the relative elaticity of the air and the steam; and if at any time the preying of steam diminishes, by the heat of the furnace, growing less, or by the engine drawing off more steam, the surface of the water in the open pipe will subside; and there is a flont-float in this pipe, balanced in the same manner.
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ner as the feeding-float before described, the deflection of the stone is made to operate upon the chain of the damper, and draw it up so as to increase the draught of the furnace, until, by the accession of heat, the steam recovers the intended preasure, and restores the damper to its place. On the other hand, when the preasure of the steam is on the increase, either from the engine being retarded or stopped, or from the furnace burning too fast, the preasure of the steam on the surface of the water in the boiler raises the water in the open pipe; and the stone-float, then rising by its balance-weight, closes the damper, and diminishes the draught, until the steam subsides to its defined force. By this means, the steam is always preferred to the same intensity; a circumstance very necessary to the regularity of the motion of the engine.

Steam-Gauge.—To ascertain the preasure of steam with a greater degree of exactitude than by the load on the surface of the safety-valve, which is liable to many uncertainties, Mr. Watt employs a steam-gauge, confining of an inverted siphon, or bent tube, of glas or iron; one leg of which is joined to the steam-pipe, and the other is open to the atmosphere. A quantity of mercury being poured into the tube, it will occupy the bent part which joins the two legs; and the surface of the mercury in one leg being exposed to the preasure of the steam, while the external air acts upon the other, it is evident that the difference of level of the two surfaces will express the preasure of the steam in the height of a column of mercury.

When the tube is of glas, this difference of level may be seen and measured on a scale; but when an iron tube is used, a small light wooden rod is made to float on the surface of the mercury in the open leg, and point out the height on a scale of inches, fixed above the tube. But in this scale the divisions, which are numbered for inches, must be only half inches; because, as the mercury descends in one leg as much as it rises in the other, the scale reads double, to shew the difference of level.

Barometer-Gauge.—Mr. Watt has also adapted a gauge, called a barometer, to indicate the degree of vacuum in his engine, an addition which is of important conformance to the good performance of the engine, to the profit of the proprietors, and the credit of the engine; yet in many engines in London, we see this important instrument either out of repair, or wholly laid aside.

The form of this barometer can be understood without a figure: it is a tube of glas, 30 inches long, filled with mercury, and applied to a scale of inches, the lower end being immered in a cup, in the same manner as the common barometer, or weather-glas; it is, in fact, the same thing as a barometer in every respect, except that the vacuum is not made in the top of the tube, in the Torricellian manner, but by the engine. For this purpose, a small copper tube is conducted from the condenser, and cemented to the top of the glas tube, by which means the surface of the mercury in the tube is relieved from the preasure of the atmosphere; and the weight of the atmosphere, which presses upon the surface of the mercury in the bacon, will cause it to mount up in the tube to a greater or less height, according as the vacuum is more or less perfect, or as the atmosphere is more or less heavy; which will be shewn by a common barometer placed at the side of the engine barometer.

The pipe which leads from the condenser to the top of the barometer tube must be provided with a cock, which should be shut when the engine is blowing through, to prevent the steam entering the tube, and blowing the mercury out of it; but the bacon for the mercury must be made large enough to contain all the mercury, because, when the engine is not at work, the air will leak in, and allow the mercury to descend into the bacon.

It has been proposed to make the barometer in the form of an inverted siphon, just the same as the common steam-gauge, one leg being made to communicate with the condenser, and the other left open to the air. In this way, the rise of the mercury in one leg produces a corresponding fall of the mercury in the other; but on this account, if the scale is applied to one leg, the divisions must be only half inches; that is, provided the two legs are of the same bore; but if they are of different bares, the scale must not be half, but of a proper proportion, to shew always the difference between the level of the surface of the mercury in the two legs.

These tubes may be made of glas; but if the quicksilver is not very pure, the alloy with which the vendors of this article adulterate it is by constistant action brought to the surface, and, together with the vapour, make the tube so foul, that no precision can be obtained. Iron is the best material for both parts of the tube, which should be correctly of one diameter, or else the result will be erroneous, as we have before remarked; for it is difficult to graduate a scale by experiment in an iron tube, where the difference of level of the mercury in the legs cannot be seen. This tube must communicate with the condenser by a small copper pipe, and a stop-cock be placed between the gauge and condenser. The index in this instrument is the same as in the steam-gauge, viz., a light deal rod, which is put into the shorter tube; and quicksilver being poured into it within three inches of the end, the rod is put into the tube, and floats on the quicksilver. It is almost needless to remark, that the graduation on this instrument must be inverted with regard to those of a single tube.

The barometer shews the perfection of the vacuum, or the preasure of the atmosphere to enter into the condenser, whilst the steam-gauge shews the preasure of the steam to escape into the air. By adding the height of these two columns together, we have the preasure of the steam upon the piston, provided the throttle-valve is fully open, so that there is no obstruction to the entrance of the steam from the boiler into the cylinder. It would be interesting to have a single gauge made to express this in one; nothing would be more easy than to have a large tube bent to an inverted siphon, and one of the legs being connected with the steam-pipe, and the other with the condenser, the difference of level between the two surfaces would at all times express the preasure on the piston.

Counter.—In many of Mr. Watt's engines, a little apparatus is attached to the beam, to ascertain the number of strokes the engine makes in any given time; this contrivance is called the counter, and is a train of wheel-work, working like clock-work, commonly attached to the beam in such a manner, that every stroke made by the engine moves one tooth, so that the index tells how many strokes have been made since last examined. This is so much up in a box, that no person can gain access to it but the one entrusted with the key. When the box is attached to the beam, the inclination of the beam causes the pendulum to vibrate every time the engine makes a stroke, and thus moves the counter round one tooth for every stroke. In other cases, the box containing the counter is fixed to the spring-beam floor, and at every stroke the beam strikes a small detent, and moves the counter one tooth. It was by the account of this instrument that Messrs. Boulton and Watt charged their portion of the savings for working their engines during the term of Mr. Watt's patent.

Construction of the Valves.—The steam and eduction-valves are of that kind called button or conical spindle-valves.
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valves. Mr. Watt, in his first essays, employed cocks, and also sliding-valves, such as the regulator or steam-valve of the old engine. But he found them always lose their tightness, after a short time. This is not surprizing, when we consider that they are always perfectly dry, and almost burning hot. He was therefore obliged to change them all for spindle-valves, which being truly ground, and nicely fitted in the seats, are not likely to get out of order, or become loose, in any length of time. Other engineers now use them commonly in the old form of the steam-engine; where, however, there is less necessity for them.

The manner of constructing these valves is as follows. Fig. 3, represents a valve, with its seat and box; suppose it one of the steam-valves: the box is at the end of the pipe which introduces the steam, and b b is the upper part of the pipe, which communicates with the lower part of the cylinder, or with the condenser. At e e may be observed a part more faintly shaded than the surrounding parts. This is the seat of the valve, and is a brass or bell-metal ring, turned conical on the outside, so as to fit exactly into a conical part, bored out in cast iron, of the pipe b b. This ring or seat is fitted in by cement; and the cone being of a long taper, the ring fits firmly in it, especially after having been there for some time, and united by ruff. The valve itself is a strong brass plate, D, turned conical on the edge, so as to fit the conical or inner edge of the seat. These two cones are very nicely ground into each other with emery. This conical joining is much more obtuse than the outer side of the ring e e, so that although the joint is air-tight, the two pieces do not stick closely together. The valve has a spindle or round tail, D c, which is freely moveable up and down in the hole of a crook-piece extended beneath the ring or seat e e; and on the upper side of the valve is a strong piece of metal, D G, firmly joined to it, one side of which is formed into a toothed rack.

A is the eccentric of an iron axle, which turns in holes in the opposite sides of the valve-box; and one of these, where it passes quite through the side of the box, is nicely fitted by grinding, so as to be air-tight; and a stuffing of hemp, well soaked in melted tallow and rosin, made to fit the end of the hole, to prevent all ingress of air. The end of this axis projects a good way without the box, and carries a spanner or handle 3, which is connected by a rod with a lever, moved by the plug-frame. To the axis, A, is fixed a strong piece of metal, or sector, the edge of which is formed into an arc of a circle, having the axis, A, in its centre, and is cut into teeth, which work in the teeth of the rack D G, on the valve, and lift the same when the sector is moved. K K is a cover, which is fixed by screws to the top of the box F 3, and may be taken off, in order to get at the valve when it needs repair. From this description it is easy to see, that by turning the handle 3, which is on the axis A, the sector must lift up the valve by means of its toothed rack D G, till the upper end of the rack touches the top or cover K; and turning the handle 3, in the opposite direction, brings the valve down again to its seat.

The force requisite to lift up a large valve from its seat is very great, the valve being kept down by a preasure of the steam upon its upper surface while there is a vacuum beneath it. The valves of the Cheltenham engine are nine inches diameter, and therefore contain (9 x 9 = 81 x .785)= 65.5 square inches, and each being prefixed by at least 13 lbs., makes 826 lbs. weight to keep the valve down; and this should, if possible, be lifted in an instant, to admit the steam to pass off without delay. One method of balancing this weight is by means of a small piston, applied beneath the valve. Thus, the lower part of the pipe or box in which the valve is contained, is bored out to a short cylinder, and a piston is truly fitted therein, as shewn beneath K, fig. 2: a cover or bottom is screwed on to close the lower end of the short cylinder; and there is a small copper pipe from the jacket, which admits steam into the space of the short cylinder beneath its piston, while there is a vacuum in the box in which the valve is contained, and which is open to the upper surface of the piston. The axis of the valve being connected with the piston, it is easy to move it up and down, and, by lifting the piston to ascend will countersink that of the valve to descend; and, therefore, by apportioning the area of the piston to that of the valve, it may be made to lift with the lightest force.

Even without this contrivance, which is only applied beneath the exhausting-valve, as is seen in the section, fig. 2, Mr. Watt invented a very simple and effective method of raising up the valves by levers. The force which holds down the valve is quite momentary; and the instant the valve is detached from its seat the pressure is over, although it has not risen more than a tenth of an inch; the force, therefore, is, therefore, no impediment to the engine, but would be an inconvenient labour to the man who crowds and drops it.

By Mr. Watt's contrivance, the lever is put in such a position when it begins to raise the valve, that its mechanical energy is almost infinitely great. Let fig. 3, represent the valve shank, which is supposed to have been just closed by the chock on the plug-beam in its deficient coming in contact with the handle s s, and depressing it, which is moveable with the axis X: on this same axis is another arm, Z Z, connected by a joint with the back of a 3, which is connected also by a joint with the lever 3 A, fixed on the axis, A, of the sector, contained within the valve-box. Therefore, when the chock of the plug-beam depresses the handle s s, and turns the arm, X Z, round upon its centre, it pushes up the lever, 3 A, by means of the connecting rod, until the valve is closed, as shewn in fig. 3. At that time, the rod 2 3, and the arm, X Z, of the lever, are in one straight line, while the lever 3 A, (on the axis of the sector,) is at right angles to rod 2 3, which moves it; consequently the rod is acting with its greatest power to turn the valve; but, as soon as the valve is kept closed by the catch or detent before explained, which holds down the handle s s, until it is wanted to be opened; the plug-frame then, by lifting the lower handle, relieves the catch, and the weight, a, applied to the axis turns it round into the position of the dotted lines, and the lever, X Z, draws the rod 2 3, and, by depressing the lever 3 A, opens the valve.

From this arrangement, the intelligent mechanic will perceive that, in this position, the force exerted by lever X Z is extremely great to pull down the rod 2 3; and, at the same time, another great advantage arises from this disposition of the levers, which is, that any preasure, however strong, applied upon the valve to open it, would be ineffectual, as that force would be exerted to turn the lever X Z endways, in the direction of the axis X, instead of turning it round, as shewn by the figure, which represents the valve shut, and retained in that position by the lever.

Construction of the Piston.—In Mr. Watt's first attempt, the greatest difficulty which he encountered was to make the great piston tight. The old and inefficient method of sticking it on it, was indissipable. He was therefore obliged to have his cylinders most nicely bored, perfectly cylindrical, and finely polished; and he made numberless trials of different soft substances for packing his piston, which should be tight without enormous friction, and long remain so, in a situation perfectly dry, and not almost to burning.

After many trials, he settled the form of the packing which is now universally employed. The piston has a projecting rim at
STEAM-ENGINE.

at bottom, which is fitted as accurately to the cylinder as it can be, to leave it at full liberty to rise and fall through the whole length. The part of the piston immediately above this is about two inches less all round than the cylinder, to leave a circular groove or channel, into which the hemp, or soft rope which is called gasket, is rammed, to form the packing; then, to keep the packing in its place, a lid or cover is put over the top of the piston, with a ring or projecting part, which enters into the circular groove for the packing, and preventing the air being forced down by pressure. Through part of the groove round the piston being made rounding, with a curve, this pressure on the packing forces it against the inside surface of the cylinder. The piston must be kept supplied with melted grease; for which purpose a funnel is fixed on the top of the cylinder, with a cock and pipe to let the grease down. The stuffing-box in the top of the cylinder, round the piston-rod, is packed with hemp in a similar manner, a collar, with a hole through it for the passage of the rod, being screwed down, to confine the packing in its place.

After all that has been done in this respect, it is probable that the greatest part of the waste of steam which we still perceive in engines, arises from the unavoidable escape of the sides of the piston during its descent. If the piston is packed so tight as to prevent the lofs, the friction is so increased as to fully outweigh the saving. But it is a fortunate circumstance, that the performance of Mr. Watt's engine is not immediately destroyed, nor, indeed, greatly diminished, by a small want of tightness in the piston. In the atmospheric engine, if air enters in this way, it immediately puts at flight the water; but in the new engine, although even a considerable quantity of steam escapes past the piston during its descent, the rapidity of condensation is such, that the diminution of pressure is not considerable, and the waste of steam is the greatest inconvenience.

A great many schemes have been since tried to make better methods of packing a piston, but none of them have been brought into use, except the metallic expanding piston, which was proposed by Mr. Cartwright, as we shall notice in describing his engine. Something of the same kind, but not for steam-engines, is to be found in Leopold's, "Machininarum Hydraulicae"

The actual Performance of Mr. Watt's Engine with respect to Coals.—At the first establishment of their engines, Messrs. Boulton and Watt charged their profits in proportion to the saving of fuel which their engine made, when compared with a common engine burning the same kind of coals. They had one-third of these savings paid them annually, or the payment was redeemed at ten years' purchase. It should be observed, that Mr. Smeaton's improvements were introduced about the same time as Mr. Watt's, and therefore the comparison was not with his engines, but with the former ones. It was Mr. Smeaton's rule, judging from some experiments made before him on some of Mr. Watt's early engines, to cheapen Mr. Watt's engine at one-half the consumption of fuel as his own for the same work, in large engines, or a still greater proportion in small engines, because the waste of steam is greater, and he reckoned his own at only one-half of the common engines, as he found them; therefore, Mr. Watt's will be four times as great in effect as the common engines.

As early as 1778, when Mr. Watt first established his engine, we find his proposals, deduced from experiment, were to raise 500,000 cubic feet of water one foot high with one cwt. of coals. He afterwards adopted the denomination of the number of pounds of water which could be lifted one foot high by a bushel of coals as the scale for engines; if we reduce this to the latter term, it will be 555 lbs. Thus, 500,000 cubic feet × 63.5 lbs.

the weight of a cubic foot of water, is 51,250,000 lbs. of water raised by 112 lbs. of coals. Then say, as 112 lbs. : 51,250,000 lbs. : 88 lbs. the weight of a bushel of coals, to 24,553,571, the number of pounds of water which will be lifted one foot high with one bushel of coals. Mr. Watt was at that time in expectation of making a great improvement by adopting his expulsive method.

Mr. Smeaton, who was defirous of promoting Mr. Watt's discovery, made an experiment in 1778, on an engine on the same principle as that of Mr. Watt's, to see how the water let down by the passage of boats through the locks.

The working cylinder was 20 inches, and the pump also 20 inches, lifting 27 feet, at the rate of 11 strokes per minute, of 5 feet 7 inches length each. It worked for an hour with 65 lbs. of Wednesbury coals.

When reduced, this experiment gives about 15 millions lifted one foot by a bushel of coals. Thus, the area of the pump is (20 × 20 = 400) × 3784 = 3144 square inches, × 434 lbs. = 156.27 lbs. weight for every foot in height, × 17 feet = 2679 lbs. the total weight of the column. The motion per minute is 634 feet (11 strokes of 5 ft. 9 in. each), or 3595 ft. per hour, × 2679 lbs. = 93961,805 lbs. raised 1 foot high per hour. The coals consumed in the hour was 65 lbs.; therefore say, as 65 lbs.: 13,961,805 lbs.: 88 lbs.: 18,902,156 lbs. raised one foot high with each bushel of coals of 88 lbs.; load on the piston 27 ft. of water, or (27 × 434 = 11,7 l. sp. sq. inch.

When the engines were made to work with the expansion, they were enabled to raise as much as 30,000,000 lbs., but this is when the engines are of the best construction, and worked under every advantage of the parts being tight and in the belt order; for these circumstances, when neglected, as they usually are by the engine-keepers, make a most material difference in the result.

In the great scale of practical operations this nicety of management cannot be expected; and accordingly, from reports on the engines now working on the mines in Cornwall, which, with the exception of a few of Woolf's engines, are all on Mr. Watt's principle, and most of them constructed by Messrs. Boulton and Watt, taking the average of the engines, both old and new, and putting them together, they were found in August, 1811, to raise only 13,500,000 lbs. one foot high for each bushel of coals which they consumed.

But when it was known by the engine-keepers that their engines were under examination, they took so much pains to improve the effects, that by gradual increase, the engines, in 1815, lifted 21,500,000 lbs. taking the average of 33 engines. This information we obtain from the monthly reports of the engines which are working for draining the mines; these were begun in the year 1811, by the agreement of a number of respectable proprietors of the valuable tin and copper mines in Cornwall, who resolved to have ascertained the real work which their respective steam-engines were performing, as it was suspected some of them were not doing duty adequate to the consumption of fuel; and for the greater certainty of attaining their object, it was agreed that a counter should be attached to each engine, and all the engines be put under the superintendence of some respectable and competent engineer, who should report monthly the following particulars in columns: namely, the name of the mine; the size of the working cylinder; whether working single or double; the load per square inch upon the piston; length of the stroke in the cylinder; the number of pump-lifts; the depth in fathoms of each lift; diameter of pumps in inches; time during which they worked; consumption of coals in bushels during that time; number of strokes during the time; length of stroke in the pump; load upon the whole area of the piston in pounds; pounds lifted
STEAM-ENGINE.

I employ the steam after it has ascended in the first vessel to operate a second time in the other, by permitting it to expand itself, which I do by connecting the vessels together, and forming proper channels and apertures, whereby the steam shall occasionally go in and out of the said vessels.

Thirdly: I condense the steam, by causing it to pass in contact with metallic surfaces, while water is applied to the opposite side. Fourthly: To discharge the engine of the water used to condense the steam, I suspend a column of water in a tube or vessel constructed for that purpose, on the principles of the barometer, the upper end having open communication with the steam-vessels, and the lower end being immerged in a vessel of water. Fifthly: To discharge the air which enters the steam-vessels with the condenising water or otherwise, I introduce it into a separate vessel, whence it is protruded by the admission of steam. Sixthly: That the condenised vapour shall not remain in the steam-vessel in which the steam is condened, I collect it into another vessel, which has open communication with the steam-vessels, and the water in the mine, reservoir, or river.

"Lastly, in cases where the atmosphere is to be employed to act on the piston, I use a piston so constructed as to admit steam round its periphery, and in contact with the sides of the steam-vessel, thereby to prevent the external air from passing in between the piston and the sides of the steam-vessel."
STEAM-ENGINE.

Lastly, the pump-rods, X, cause the outer end of the beam to preponderate, so that the quiescent position of the beam is that represented in the figure, the pistons being at the top of the cylinders.

Suppose all the cocks open, and steam coming in copiously from the boiler, and no condensation going on in L, the steam must drive out all the air, and at last follow it through the valve Q. Now shut the cocks b and d, and open the valve, S, of the condenser; the condensation will immediately commence, and draw off the steam from the lower part of the great cylinder. There is now no prejudice on the under side of the piston of the great cylinder A, and it immediately descends. The communication, Y, between the lower part of the small cylinder B, and the upper part of the great cylinder A, being open, the steam will go from the lower part of B, into the space left by the descent of the piston of A. It must, therefore, expand, and its elasticity must diminish, and will no longer balance the prejudice of the steam coming from the boiler, and pressing above the piston of B.

This piston, therefore, if not withheld by the beam, would descend till it came in equilibrio, from having steam of equal density above and below it. But it cannot descend so fast; for the cylinder A is larger than B, and the arch of the beam, at which the great piston is suspended, is no longer than the arm which supports the piston of B; therefore, when the piston of B has descended as far as the beam will permit it, the steam between the two pistons occupies a larger space than it did when both pistons were at the top of their cylinders, and its density diminishes as its bulk increases. The steam beneath the small piston is, therefore, not a balance for the steam on the upper side of the same, and the piston B will act to depress the beam, with all the difference of these prejuires.

The lightest view of the subject must throw the reader, that as the pistons descend, the steam that is between them will grow continually rarer and less elastic, and that both pistons will draw the beam downwards. Suppose now, that each one had reached the bottom of its cylinder, shut the cock a, and the eduction-valve at the bottom of A, and open the cocks b and d. The communication being now established between the upper and lower part of each cylinder, the pistons will be press'd equally on the upper and lower surfaces; in this situation nothing, therefore, hinders the counter-weight from raising the pistons to the top.

Suppose them arrived at the top: the cylinder B is at this time filled with steam of the ordinary density; and the cylinder A with an equal absolute quantity of steam, but expanded into a larger space. Shut the cocks b and d, and open the cock a, and the eduction-valve at the bottom of A; the condensation will again operate, and cause the pistons to descend; and thus the operation may be repeated as long as steam is supplied; and once full of the cylinder B, of ordinary steam, is expended during each working stroke.

The cocks of this engine are composed of two flat circular plates, ground very true to each other, and one of them turns round on a pin through their centres; each is pierced with three sectorial apertures, exactly corresponding with each other, and occupying a little less than one-half of their surfaces. By turning the moveable plate so that the apertures coincide, a large passage is opened for the steam; and by turning it so that the forty part of the one apertures of the other, the cock is thus. Such regulations are now very common in the cast-iron flues for warming rooms.

Mr. Hornblower's contrivance for making the collars for the piston-rods air-tight, is thus: the collar is in fact two, placed at a small distance from each other; and a small pipe, branching off from the steam-pipe, communicates with the space between the collars. This steam being a little stronger than the pressure of the atmosphere, effectually prevents the air from penetrating through the upper collar; and though a little steam should get through the lower collar into the cylinder A, it can do no harm. The manner of making this stuffing-box is as follows: on the top of the cylinder is a box to contain something soft, yet pretty close, to embrace the piston-rod in its motion up and down; and this is usually a fort of plaited rope of white yarn, nicely laid in, and rammed down gently, occupying about a third of its depth; upon that is placed a fort of tripod, having a flat ring of brass for its upper, and another for its lower part; and these rings are in breadth equal to the space between the piston-rod and the side of the box. This compound ring being put on over the end of the piston-rod, another quantity of this rope is to be put upon it, and gently rammed as before; then there is a hollow space left between these two packings, and that space is to be supplied with strong steam from the boiler. Thus is the packing about the piston-rod kept in such a state as to prevent the air from entering the cylinder at any time there may be a partial vacuum above the piston.

Mr. Hornblower's description of this engine was followed by a mathematical investigation of the principles of its action, by the ingenious professor Robison, which demonstrates that it is the same thing in effect as Mr. Watt's expansion-engine; but though this is true, there is a considerable difference in the steps by which the effect is attained, which gives an important advantage when it is reduced to practice. We shall give an investigation in a more popular form, using only common arithmetic. Mr. Hornblower assumed, that the power or prejudice of steam is inversely as the space into which the steam is expanded; this is the case with air, and for the present we will grant it to be so with steam, and reason from the same data as the ingenious inventor gives us.

To explain clearly what paffes in the two cylinders, we must deviate from the precise form of the engine, and direct ourselves of one complication of ideas, by reducing both cylinders to the same stroke; therefore, suppose the engine to have two like fig. 2, which represents the two cylinders placed one upon the other, the lower one being double the capacity of the upper one, and both pistons being attached to the same rod, which may be applied to the end of the beam, so that the descent of the pistons must draw up the load at the opposite end of the beam.

Then, if we suppose the small piston to be 10 inches in diameter, the great piston must be 14.14 inches; and to avoid all difficulties of the ratio of the expansion, and the prejudice of steam, we will suppose the engine to be worked by the prejudice of atmospheric air instead of steam, and for the convenience of round numbers in our calculation, we will consider the prejudice at only 10 lbs. per circular inch on the surface of the piston.

The area of the small piston will be 100 circular inches, and being assumed to move without friction, the prejudice upon it will be 10 x 100 = 1000 lbs. The area of the great piston is twice as much, or 200 circular inches, and the prejudice 2000 lbs.

Suppose both pistons to be at the top of their respective cylinders; let the atmospheric air be admitted to press freely upon the upper surface of the small piston; and suppose...
STEAM-ENGINE.

This force would balance a load of 2000 lbs.; but suppose we diminish the load to 1000 lbs., then the pistons will immediately begin to descend; but they will soon stop, because the air between the two pistons must expand itself, to fill the increasing space occasioned by the equal descent of both pistons in the cylinders, one of which is twice the area of the other; and as the air becomes rarer, its pressure on the great piston must diminish. Now as this same diminution occurs the small piston to have a power of descent, we will first consider the pistons separately, and then conjointly, in their power of descent, which with which they draw down the beam.

<table>
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<tr>
<td>At first the power will be - 2000 Lbs.</td>
<td>At first the power will be 0 Lbs.</td>
<td>At first - 2000 Lbs.</td>
</tr>
<tr>
<td>At one-fourth of the descent, the power will have diminished, 1600 by regular decrements, to</td>
<td>At one-fourth, the power will be 200</td>
<td>At one-fourth - 1800</td>
</tr>
<tr>
<td>Because the air between the two pistons must occupy three-fourths of the small cylinder, and one-fourth of the great cylinder, and the space equal to one and one-fourth of the original space which it filled; therefore the spaces will be as five to four; and if the density of air is as the inverse proportion of the space which it occupies, the pressure on the great piston must be as four to five, or 133 1/3.</td>
<td>Because the equilibrium does not continue, and at one-fourth of the descent the pressure beneath the small piston is reduced by the expansion of the air between the two pistons to four-fifths of 1000 = 800 lbs., while the pressure above the piston continues to be 1000. The power is, therefore, 1000 - 800 = 200.</td>
<td>At one-half - 1666 2/3</td>
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<tr>
<td>At one-half of the descent, the power will have diminished to 1143 2/3</td>
<td>At three-fourths of the descent, the power will have increased to 428 1/2</td>
<td>At three-fourths - 1571 1/2</td>
</tr>
<tr>
<td>Because the air must now occupy one-half of the small cylinder and one-half of the great one, which is a space equal to one and one-half of the space it filled originally. The spaces will therefore be as five to four, and the pressure on the great piston to four to five, or 1/2 of 2000 = 1143.</td>
<td>Because the pressure beneath is diminished by the increased rarity of the air to 1000 = 666 2/3, while the downward pressure continues to be 1000. The power is therefore 1000 - 666 2/3 = 333 1/3.</td>
<td>At the bottom - 1500</td>
</tr>
<tr>
<td>At the bottom, the power will be 1500</td>
<td>Because the air beneath the piston is reduced to one-half of its preasure, or 500, which deducted from 1000, leaves 500.</td>
<td>Sum of the combined powers - 8538</td>
</tr>
<tr>
<td>Sum of the powers exerted by the great piston in its descent 7075</td>
<td>Sum of the powers of the small piston - 1461</td>
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Sum of the powers - 8538
STEAM-ENGINE.

Now let us consider how Mr. Watt's principle of expansion would operate in the same circumstances; that is, in a cylinder of 14.14 inches diameter; which is to be supplied with air of 10 lbs. pressure per circular inch, until it has completed one-half of its descent, and leaving the remainder of the descent to be accomplished by the expansion of the air already contained in the upper half of the cylinder.

At the beginning, the power of descent will be
At one-fourth, the power will be
At one-half, the power will be
At three-fourths of the descent, the power will be diminished to

\[ \text{Lbs.} \]
\[ 2000 \]
\[ 2000 \]
\[ 2000 \]
\[ 1333 \frac{1}{3} \]

Because the air must occupy one-fourth of the length of the cylinder, in addition to that half of the cylinder which it occupied before the expansion began; therefore the space is one and a half times the former, or as three to two, and the pressure will be two-thirds of 2000.

At the bottom the pressure will be

\[ \text{Lbs.} \]
\[ 1000 \]

Because the air is expanded to occupy twice the space it filled before.

\[ \text{Lbs.} \]
\[ 833 \frac{1}{3} \]

The sum total is very nearly the same as the former, but both are greater than they should be, from the imperfect manner in which we have been obliged to make our calculation, so as to express it in common arithmetic, without having recourse to fluxions, which is the only method of treating quantities that are constantly increasing or decreasing by any given law.

The source of the inaccuracy is easily explained: at first we set out with the pressure at 2000 lbs. in Mr. Hornblower's engine, and did not take into the account that it decreases at all, until the piston has descended to one-fourth, but reasoned as though it diminished all at once at that place; whereas it began to diminish from the very first starting. Here then we have taken a small quantity too much. In the same manner, our process takes no notice of the diminution which happens between one-fourth and one-half of the descent, or between the other points at which we have chanced to examine it; the result is, as if the diminution took place suddenly at each of those points. The remedy for this would have been to have taken the account at a greater number of places, as it is by fluxions alone that we can take an infinite number, so as to obtain a true result. Now in the second calculation of Mr. Watt's expansion-engine, we have taken a still fewer number of steps for the consideration of the expansion, because, although there are four steps in the process, two of them are before the expansion begins.

This is the reason of the apparent difference; for in reality there is none in the sum total of the varying powers exerted through the whole stroke, as will appear to any person who will take the trouble to read professor Robison's investigation. But if we consider the difference of the manner in which the whole power is expended during the stroke, we shall find great reason to prefer Mr. Hornblower's method, from the much greater uniformity of the action; it begins at 2000, and ends at 1500; whilst Mr. Watt's begins at 2000, and ends at 1000; hence the facility of those ingenious contrivances for equalizing the action in Mr. Watt's patent of 1788. Mr. Hornblower's is not uniform, but approaches uniformity more nearly, so that he could have carried the effect of the expansive principle much farther, in employing stronger steam, than we believe he ever proprosed to do.

We have been thus full upon this subject, because the gaining more power by the expansion of air or steam acting in double cylinders, has been a favourite idea with many, and there are no less than five different patents for it, but several of these have been upon mistaken notions; neither Mr. Watt's nor Mr. Hornblower's can have any advantage from shutting off the air, or from a double cylinder, when air is used to press the piston; nor could they derive any advantage from the expansion of steam in their engines, if the pressure of it was inversely as the space it occupies.

The advantage of the expansive principle arises wholly from a peculiar property of steam, by which, when suffered to expand itself to fill a greater space, it decreases in pressure or elastic force by a certain law, which is not fully laid down; that is, the relation between its expansive force and the space which it occupies is not clearly decided; but Mr. Woolf has found that, by applying these properties in their fullest extent to the double cylinder engine, he can make most important improvements in the effects which can be obtained from any given quantity of fuel. Steam is a fluid far different from air, as to have no one property in common with it, except elasticity. This elasticity is wholly derived from the quantity of heat which it contains, and its force increases and diminishes with the quantity of heat; but by what law it increases or diminishes we are uncertain, because we have no measure of the actual quantity of heat which is contained in steam of any given elastic force. All we know with certainty is what is stated in our table of expansion, viz. that water, being converted into steam, and confined in a close vessel, when heated until the thermometer indicates a certain temperature, will have a certain prelude or elastic force. But here we must observe, that the thermometer indicates only the intensity of the heat, without affording a direct measure of its quantity. When steam is suffered to expand itself into any given space, the quantity of rarefied water which will be found to be contained in any given bulk of steam, in its expanded state, must be undeniably proportioned to the quantity of water contained in the same bulk of the steam, before the expansion took place, in the inverse ratio of the space which it originally occupied, and that space which it fills when expanded; but we cannot say that this is the case with heat; and it is the quantity of heat alone which determines the elastic force. The reason.

We believe that in practice Mr. Hornblower was not able to obtain any greater effect from the application of the expansive action in two cylinders, than Mr. Watt did in one cylinder. In 1791-2, he erected an engine in Cornwall, at Tin-Croft mine, of which the large cylinder was 27 inches diameter, and worked with a stroke of eight feet long, and the small cylinder 21 inches diameter, working with a fixed stroke. The only account we have been able to obtain of the performance of this engine, is from a pamphlet published by Thomas Wilton, an agent of Mellis, Boulton and Watt, professedly with a view to prevent the introduction of Mr. Hornblower's engines into that country, in which he makes it appear, that it raised only \(14,223,120\) lbs. of water one foot high with each bushel of coal.

In Mr. Hornblower's own account of his engine, in Gregory's Mechanics, he informs us, that "an engine was erected in the vicinity of Bath, some years since, on this principle, and under very disadvantageous circumstances. The engine had its cylinders 19 inches and 24 inches diameter, with lengths of stroke in each suitable to the occasion: viz. 6 feet and 8 feet respectively. The confessing apparatus was very bad, through a fear of infringement on Mr. Watt's patent; and the greatest degree
of vacuum which could be obtained, was no more than 27 inches of mercury. The engine worked four lifts of pumps to the depth of 376 feet, 4,000 lbs. 14 strokes in a minute, 6 feet each, with a cylinder 6 feet long, and 19 inches diameter, with a great deal of inertia and friction in the rods and buckets: some of the latter of which were not more than 34 inches diameter; and this it did, under all these disadvantageous circumstances, with 70 lbs. of coal (light coal) per hour."

To reduce this to the standard of one foot high, we must put the load 4,000 lbs. x 6 feet stroke = 27,000 lbs. which the engine raised one foot high at every stroke; 27,000 lbs. x 14 strokes per minute = 378,000 lbs. raised one foot high each minute; 378,000 lbs. x 60 = 22,680,000 lbs. raised one foot high per hour, or with 70 lbs. of coal. As the coals are flated to be light, we will take them at only 84 lbs. per bushel, instead of 88 lbs. as Mr. Smeaton did, and say as 70 lbs. = 22,680,000 lbs.; 84 lbs. = 27,316,000 lbs. of water raised one foot high with a bushel of coals, which is a very good performance, but not greater than Mr. Watt's.

In this engine, Mr. Hornblower says that two remarkable circumstances prevented themselves to show the advantages of this application of the principle: the one was, that the man who attended the engine would sometimes detach the smaller cylinder from the beam, and work only with the large one, and then the boiler would scarcely raise steam enough to keep the engine going; but no sooner was the small cylinder-rod attached to the beam, than the engine resumed its wonted activity, and the steam would blow up the safety-valve.

The next circumstance is, that when the detent, which kept the exhausting-valve shut, happened to miss its action, the piston would be checked, as it was, not being permitted to rise through the whole of the returning stroke; and it would, as by an instructive nature, come down again and again, until the detent performed its office, which is a practical argument for the power of the engine at the termination of its stroke.

In 1792, Mr. Hornblower made application to parliament for an extension of the term of his patent, but it was not granted; and he was prosecuted by Meirs. Boulton and Watt for infringement on their patent in using the condenser and air-pump. We believe none of these engines have been erected since the expiration of Mr. Watt's patent in 1800, until Mr. Woolf took up the subject of double-cylinder engines.

Mr. Woolf's Double-Cylinder Expansion-Engine.—In 1804, Mr. Arthur Woolf had a patent for improvements in steam-engines. The specification of his invention states, that he has ascertained by actual experiment, and reduced to practice, the following particulars respecting the expansibility of steam. That, in practice it is found that steam, acting with the expansive force of four pounds per square inch against a safety-valve exposed to the atmosphere, is capable of expanding itself to four times the volume it then occupies, and still to be equal to the pressure of the atmosphere: that, in like manner, steam of the force of five pounds the square inch, can expand itself to five times its volume; and that masses or quantities of steam of the like expansive force of five pounds per square inch, can expand to fix, seven, eight, nine, or ten, pounds pressure per square inch, in atmosphere, and be still equally equal to the atmosphere, or capable of producing a sufficient action against the piston of a steam-engine, to cause the same to rise in the atmospheric engine of Newcomen with a counterpoise, or to be carried into the vacuous part of the cylinder of the improved engine, first brought into effect by Mr. Watt: that this ratio is progressive, and nearly, if not entirely, uniform; so that steam prepping with the expansive force of 20, 30, 40, or 50 pounds the square inch against a common safety-valve, will expand itself to 20, 30, 40, or 50 times its volume; and that generally, as to all the intermediate or higher degrees of elastic force, the number of times which steam of any temperature and force can expand itself, is nearly the same as the number of pounds it is able to sustain on a square inch exposed to the common atmospheric counter-pressure; provided always, that the space, place, or vessel, in which it is allowed to expand itself, be kept at the same temperature as that of the steam, before it is allowed room to expand.

Respecting the different degrees of temperature required to bring steam to, and maintain it at, different expansive forces above the weight of the atmosphere, Mr. Woolf states that he has found by actual experiment, setting out from the boiling point of water, or 212° of Fahrenheit, at which degree steam of water is only equal to the pressure of the atmosphere; that, in order to give an increased elastic force equal to five pounds on each square inch, the temperature must be raised to about 227.9°, when it will have acquired a power to expand itself to five times its volume, and still be equal to the atmosphere, and capable of being applied as such in the working of steam-engines, according to his invention. Various other pressures, temperatures, and expansive forces of steam, are shewn in the following table.

Woolf's Table of the relative Pressures per square Inch: the Temperature and Expanability of Steam at Degrees of Heat above the boiling Point of Water, beginning with the Temperature of Steam of an elastic Force equal to five Pounds per square Inch; and extending to Steam able to sustain forty Pounds on the square Inch.

<table>
<thead>
<tr>
<th>Pounds per square inch</th>
<th>Degrees of Heat</th>
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<tbody>
<tr>
<td>5</td>
<td>227.9</td>
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<tr>
<td>6</td>
<td>230.7</td>
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<td>7</td>
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<td>40</td>
<td>314.5</td>
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And
STEAM-ENGINE.

And so in like manner, by small additions of temperature, an expansive power may be given to steam to enable it to expand to 50, 60, 70, 80, 90, 100, 200, 500, or more times its volume, without any limitation but what is imposed by the frangible nature of every material of which boilers and other parts of steam-engines can be made. And prudence dictates, that the expansive force should never be carried to the utmost which the materials can bear, but rather be kept considerably within that limit.

Having thus explained the nature of his discovery, Mr. Woolf proceeds to give a description of his improvements grounded thereon.

If the engine is constructed originally with the intention of adopting these improvements, it ought to have two steam-cylinders of different dimensions, and proportioned to each other, according to the temperature, or the expansive force determined to be communicated to the steam made use of in working the engine; for the smaller steam-vessel or cylinder must be a guide for the larger. For example; if steam of forty pounds the square inch is fixed on, then the smaller cylinder should be at least one-fourth part the content of the larger one. Each cylinder should be furnished with a piston, and the smaller cylinder should have a communication, both at its top and bottom, (top and bottom being here employed merely as relative terms, for the cylinders may be worked in a horizontal, or any other required position, as well as vertical,) with the boiler which supplies the steam; and the communications, by means of cocks or valves of any construction adapted to the use, are to be alternately opened and shut during the working of the engine.

The top of the small cylinder should have a communication with the bottom of the large cylinder, and the bottom of the smaller one with the top of the larger, with proper means to open and shut these alternately by cocks, valves, or any other well-known contrivance. And both the top and bottom of the larger cylinder should, while the engine is at work, communicate alternately with a condensing vessel, into which a jet of water is admitted to hasten the condensation; or the condensing vessel may be cooled by any other means calculated to produce that effect.

Things being thus arranged, when the engine is set to work, the steam of a high temperature is admitted from the boiler to act by its elastic force on one side of the smaller piston, while the steam which has last moved it has a communication with the larger steam-vessel or cylinder, where it follows the larger piston, now moving towards that end of its cylinder which is open to the condensing vessel. Let both pistons end their stroke at one time, and let us now suppose them both at the top of their respective cylinders, ready to descend; then the steam of forty pounds the square inch, entering above the smaller piston, will carry it downwards; while the steam below it, instead of being allowed to escape into the atmosphere, or applied to any other purpose, will pass into the larger cylinder above its piston, which will make its downward stroke at the same time that the piston of the smaller cylinder is doing the same thing; and while this goes on, the steam which last filled the larger cylinder in the upward stroke of the engine will be passing into the condenser, to be condensed during the downward stroke. When the pistons in the smaller and larger cylinder have thus been made to descend to the bottom of their respective cylinders, then the steam from the boiler is to be shut off from the top, and admitted to the bottom of the smaller cylinder. The communication between the bottom of the smaller and the top of the larger cylinder is also to be cut off; and the communication is to be opened between the top of the smaller and the bottom of the larger cylinder. The communication between the bottom of the larger cylinder and the condenser is to be cut off, and the steam which, in the downward stroke of the engine, filled the upper part of the larger cylinder, suffered to flow off to the condenser. The engine will then make its upward stroke from the pressure of the steam in the top of the small cylinder, acting beneath the piston of the great cylinder, and so on alternately, admitting the steam to the different sides of the smaller piston, while the steam last admitted into the smaller cylinder passes alternately to the different sides of the larger piston in the larger cylinders; the top and bottom of which are at the same time made to communicate alternately with the condenser.

In an engine working in the manner just described, while the steam is admitted on one side of the piston into the smaller cylinder, the steam on the other side has room made for its admission into the larger cylinder, on one side of its piston, by the condensation taking place on the other side of the large piston which is open to the condenser; and that waste of steam which takes place in engines worked only by the expansive force of steam, from steam passing the piston, is prevented; for all steam that passes the piston in the smaller cylinder is received into the larger.

In such an engine, where it may be more convenient for any particular purpose, the arrangement may be altered, and the top of the smaller made to communicate with the top of the larger cylinder; in which case the only difference will be, that when the piston in the smaller cylinder descends, that in the larger will ascend, and vice versa; which, on some occasions, may be more convenient than to have the two pistons moving in the same direction.

This engine is exactly the same in its actions as Mr. Hornblower's, which we have before described. The novelty consists in the application of steam of a high pressure thereto, and in proportioning the capacities of the two cylinders to the expansibility of the steam, according to his table. But Mr. W. goes on to state, that effectual means must be used to keep up the requisite temperature in all parts of the apparatus into which the steam is admitted, and in which it is not intended to be condensed; and here it may be proper to state, that instead of the usual means of accomplishing this, by inclining them in the boiler, or in a steam-safe communicating with the boiler, the separate fire may with advantage be made under the steam-safe containing the cylinders, which in that event will become a second boiler, and must be furnished with a safety-valve, to regulate the temperature. By means of the last-mentioned arrangement, the steam from the smaller cylinder or steam-measurer may be admitted into the larger cylinder, when kept at a higher temperature than the steam in the smaller cylinder, by which its power to expand itself may be increased; and, on the contrary, by keeping the larger cylinder at a lower temperature than the smaller, its expansibility will be lessened, which, on particular occasions, and for particular purposes, may be desirable. In every case, care must be taken that the boiler, or cafe in which the cylinder is incloded, the steam-pipes, and generally all the parts exposed to the action of the expansive force of the steam, shall have a strength proportional to the high pressure to which they are to be exposed.

It is not advisable that the proportion of the capacity of the smaller cylinder or steam-measurer, to the capacity of the larger or working cylinder, should in any case be smaller than the proportion of the expansion of the steam which is to be used in it, as we have stated; yet in the making of it larger, considerable latitude may be allowed; for example, with steam of forty pounds the square inch, a small cylinder or measurer of one-twentieth, or even larger, instead of one of fortieth the capacity of the larger or working cylin-
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der, and so with steam of any given strength. And in many cases, it may be advisable that this should be the case, because of the difficulty of preventing some waste of steam, or partial condensation, which might lessen the rate of working, if not allowed for in the case of the small cylinder or steam-mesfurier.

In all cases when the engine is ready for working, whatever may be the proportion that has been adopted, or intended to be worked with, it should have its power tried by altering the load on the valve that actuates the force of the steam, in order that the strength of steam belt adapted for the engine may be ascertained, and it may be turned out to be advantageous, that the steam should be employed in particular engines of an elastic force, somewhat over or under what was first intended.

Mr. Woolf also states, that Mr. Watt's engines may be improved by the application of his discovery in making the boiler, and the steam-cake in which the working cylinder is included, much stronger than usual, and by altering the structure and dimensions of the valves for admitting steam from the boiler into the cylinder in such a manner, that the steam may be admitted very gradually by a progressive enlargement of the aperture, so as first to wire-draw the steam, and afterwards to admit it more freely. The reason of this precaution is this, that steam of such elastic force as Mr. Woolf proposes to employ, if admitted suddenly into the cylinder, would strike the piston with a force that would endanger the safety and durability of the engine. The aperture allowed to the valve for admitting steam into the cylinder, or cylinders, should be regulated by the following consideration. If the intention is, that the engine should work wholly, or almost wholly, by condensation, the steam, in passing into the cylinder, should be forced to wire-draw itself only so much, that the piston may perform the whole, or a great part of the stroke, by the time that the intended quantity of steam has been admitted into the cylinder. For example, when steam of forty pounds on the square inch is used, such a quantity of it must be allowed to enter as shall be equal to one-fourth of the capacity of the cylinder, and so in proportion when steam of any other force is employed; and when the requisite quantity has been admitted, the steam is to be shut off till the proper moment for admitting a fresh quantity. But if it is intended that advantage shall also be taken of the elastic force of the steam acting on one side of the piston, while condensation goes on on the other side, then the steam must be admitted more freely, but still with caution at first, for the reason already mentioned.

This latter is the same thing as Mr. Watt's expansion-engine; but with the addition of gradually diminishing the aperture of the steam-valve as the piston descends, instead of stopping it altogether at a certain portion of the descent, by which means the action of the engine is rendered more uniform. We think that, by regulating the descent of the valve by an accurate movement, a very good effect may be produced in this manner, without the complication of two cylinders or other parts; the only objection is, that if at any time the valve should be fully opened by accident, the pressure might suddenly become too great, from the strong steam acting upon the full surface of the piston, as to break the engine to pieces.

In 1805, Mr. Woolf took out a second patent for further improvements, in which he proposes, as before, to apply first to the cylinder itself, to heat the steam after it is thrown into the working cylinder; and this was to be done by a fire being placed beneath the case containing the cylinder: the space between the case and the cylinder was to be filled with oil, wax, fusible metal, or mercury. He also proposes a method of preventing the passage of any of the steam from that side of the piston which is acted upon by the steam, to the other side, which is open to the condenser. In those steam-engines which act as double engines, he effects this by employing upon, or about the piston, a column of mercury, or fluid metals, in an altitude equal to the pressure of the steam. The efficacy of this arrangement will, he says, appear obvious, from attending to what takes place in the working such a piston. When the piston is ascending, that is, when the steam is admitted below it, the space on its upper side being open to the condenser, the steam, endeavouring to pass up by the side of the piston, is met, and effectually prevented by the column of metal, equal or superior to it in pressure; and during the down stroke no steam can possibly pass without first forcing all the metal through.

In working what is called a single engine, a less considerable altitude of metal is required, because the steam always acts on the upper side of the piston; and in this case, oil or wax, or fat of animals, or similar substances in sufficient quantities, will answer the purpose. But care must be taken, either in the double or single engine, when working with thin pistons, that the outlet which conveys the steam to the condenser shall be so situated, and of such a size, that the steam may pass freely, without forcing before it, or carrying with it, any of the metal, or other substance employed, that may have passed by the piston: and at the same time providing another exit for the metal, or other substance collected at the bottom of the cylinder to convey the fame into a reboiler kept at a proper heat, whence it is to be returned to the upper side of the piston by a small pump, worked by the engine, or by some other contrivance. In order that the fluid metal used with the piston may not be oxidated, some oil or other fluid substance is always to be kept on its surface, to prevent its coming in contact with the steam: and to prevent the necessity of employing a large quantity of fluid metal, although the piston must be as thick as the depth of the column required, the diameter need be only a little less than the steam-veil or working cylinder, excepting where the packing, or other fitting, is necessary, or for applying the same, or to such an extent, that in fact, the column of fluid metal forms only a thin body round the piston.

We have seen an engine of an eight-horse power of this kind at work, with a fluid metal on the pistons: it effectually prevented the leakage. But as it required to have the cylinders twice as long as usual, in order to have sufficient room for the long or thick pistons which it required, and as these pistons must be of considerable weight, the method is not at all applicable in practice; and, indeed, the increase of the bulk of the moving parts is such as to counterbalance the advantage, which is confined to the saving of steam by leakage: for the friction must be greater than in another engine, because the piston must be packed as tight as usual, to be able to sustain a column of fluid metal, which must be more than equal in pressure to that of the steam; and when the steam presses upon the piston, the pressure of the fluid metal to leak by the piston must be double that of the steam; also, the friction of so great a surface of fluid metal pressing against the inside of the cylinder is very great.
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cylinder, he places a separate vessel, communicating with the lower part of the cylinder by a large pipe or passage from the bottom of each; then steam, being admitted into this vessel, will pass upon the surface of the oil or fluid metal contained in it, and force the same to pass out of that vessel into the cylinder, where it will act beneath the piston to press the same up-wards; a vacuum being at the same time made in the upper part of the cylinder, to give effect to the preasure. The steam is then made to pass upon the upper surface of the piston, which is always covered with a quantity of the fluid; and at the same time a vacuum is made in the separate vessel, so as to relieve the surface thereof from all preasure; in consequence, the piston is made to descend. It is evident that the piston must be packed so tight as to suffer none of the fluid to pass by it; but this is easy, in comparison with the difficulty of making a packing sufficiently tight to refill the passage of steam, particularly when it is so rare as the expanded steam which Mr. Woolf sometimes uses in his engine. The separate vessel of which we have spoken, is in some cases to be the jacket or space which surrounds the cylinder, which is then to be open at both ends.

This contrivance is ingenious, but we think the necessity of an additional cylinder is an objection which will prevent its adoption in large engines; and for small engines the advantages are not so great.

Performance of Mr. Woolf's Engine.—Since his first patent, Mr. Woolf has erected several small engines, which performed well, and with an evident economy of fuel. But these engines were employed to turn mills, of which the operations do not afford so exact an estimate of the power as the operation of pumping water. Mr. Woolf's engines did not come to a direct and indisputable comparison with those on Mr. Watt's principle, until 1815, when two large engines were set to work in Cornwall, at Wheal Vor and Wheal Abraham mines, for pumping water; and these have since been regularly reported in Mefirs. T. and J. Leans reports, of which we have before spoken, and of which one of the objects was to ascertain the comparative merit of the double and single cylinder engines.

The report for May, 1815, states the average performance of these two engines at 99,862 lbs. lifted one foot high for each bushel of coals; and since that time they have done more than 50,000,000 lbs.

The engine at Wheal Vor has a great cylinder of 53 inches diameter, and 9-feet stroke; and the small cylinder is about one-fifth of the contents of the great one. The engine works six pumps, which, at every stroke, raise a load of water of 37,952 lbs. weight 7½ feet high, which is the length of the stroke in the pumps. This makes a preasure of 14.1 lbs. per square inch on the surface of the great piston, and it makes 7.5 strokes per minute. With respect to its consumption of coals, it raised, in March, 1816, 48,432,702 lbs. one foot high with each bushel; April, 1816, 44,000,000 lbs.; May, 1816, 49,500,000 lbs.; and in June, 1816, 43,000,000 lbs.

From the same reports we learn, that the engine at Wheal Abraham mine has a great cylinder of 45 inches diameter, working with a 7-feet stroke, at the rate of 8.4 strokes per minute, under a load of 24,450 lbs., which it raises 7 feet at each stroke. Its performance during the above four months was 55,000,000 lbs.; in May, 4,909,000 lbs.; in May, 56,917,532 lbs., which, we believe, is the greatest performance ever made by a steam-engine; and in June, 51,500,000 lbs.

We have before given a similar account of Mr. Watt's engines, but at the same time we must observe, that the variation in the performance of different steam-engines, which is a construction upon the same principle, and working on the same advantages, is the same as would be found in the produce of the labour of so many different horses, or other animals, when compared with their consumptive food; for the effect of different steam-engines will vary as much from small differences in the proportions of their parts, as the strength of animals from the vigour of their constitution: and, again, there will be as great differences in the performance of the same engine, when in bad or good order, from all the parts being tight and well oiled, to move with little friction, as there is in the labour of an animal, from his being in good or bad health, or excessively fatigued; but, in all cases, there will be a maximum which cannot be exceeded, and an average which we ought always expect to attain.

Plate V. fig. 3, is a sketch to show the arrangement of the valves and cylinders of these two engines: A is the large cylinder, and B the little cylinder, each inclosed in its steam-case. The steam is admitted from the boiler into the steam-case of the large cylinder A, by a communication at C; and there is a communication between this steam-case and that of the small cylinder so that all the steam for the supply of the engine passes through both of the steam-cases, which therefore become part of the communication between the boiler and the little cylinder, into which the steam is first admitted. D furnishes a communication for carrying back to the boiler any water which may be produced by condensation in the steam-case, before the engine is heated to the proper temperature. E is the pipe from the steam-case to supply the engine; it has a regulating-valve. F is the valve-box of the small cylinder, the spindle of the one valve working through that of the other; and the passage for the steam from the case into the small cylinder is situated between the two valves. G is the valve that opens the communication between the bottom of the small cylinder B, and the top of the large cylinder A, when the pistons thereof are to be pressed down. H is the valve that returns the steam from above to below the large piston, when the piston is to ascend. And I is the exhaustion-valve, to carry off the steam to the condenser.

When the engine makes its down-stroke, the upper valve at F is opened, and admits the steam from the case to press upon the small piston, the valve G being opened at the same time, which suffers the steam to pass from the under side of the small to the upper side of the large piston; and the valve I is opened to make a passage from beneath the great piston to the condenser. These upper valves, F, G, I, open at the same instant of time.

When both pistons arrive at the bottom of their respective cylinders, these three valves are shut all together, and the lower steam-valve at F is opened, to return the steam from above to below the small piston; the valve H doing the same to the large cylinder, and both pistons return in equilibrio by the counter-weight; but the upper valve at F can be shut off at any part of the stroke, according to the load of the engine.

Those who are conversant with steam-engines will perceive, from the passing of the steam, as above described, from the upper to the lower side of each of the pistons respectively, that the engines at Wheal Vor, and at Wheal Abraham, are all of them perfect working with a single stroke. Were these engines working double, the steam would, on the down-stroke, be made to pass, the same as before described, from the under side of the small, to the upper side of the large piston, steam from the boiler in the mean time coming in upon the small piston, and the under side of the large piston being open to the condenser.
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condenser; but on the up-stroke, the action would be different from what we have described, for the steam would pass from the top of the small cylinder to beneath the large piston, while steam would be admitted from the boiler under the small piston, the top of the large cylinder being open to the condenser.

Mr. Woolf's Boiler for raising Steam of a high Pressure with Safety.—The boilers which Mr. Woolf employs in his engines are different from those of other engines which work with steam of a low pressure, the water being contained in several cylindrical tubes of cast-iron, which are filled with water, and exposed to the flame nearly in an horizontal position, at right angles to the axis of the boiler.

Mr. Woolf has a patent for this boiler, which the specification states to consist of two or more cylindrical vessels, properly connected together, and so disposed, as to constitute a strong and fit receptacle for the water intended to be converted into steam of a temperature and under a pressure uncommonly high, and also to present an extensive portion of convex surface to the current of flame and heated air from a fire; likewise of other large cylindrical receptacles placed above the former cylinders, and properly connected with them, for the purpose of containing some water and the steam.

These cylindrical vessels are set in a furnace so adapted to them, as to cause the greater part of the surface of each of them, or as much of the surface as may be convenient, to receive the direct action of the fire, or heated air or flame.

Plate V. figs. 4 and 5, represents one of these boilers in its most simple form. It consists of eight tubes, marked a, made of cast-iron, or any other fit metal, which are each connected with the larger cylinder A, placed above them, as is shown in the side view, fig. 5, in which the same letters refer to the same parts as in fig. 4. In fig. 5, is also shown the manner in which the fire is made to act. The fuel rests on the grate-bars at B, and the flame, and heated air, being reverberated from the part above the two first smaller cylinders, go under the third, over the fourth, under the fifth, over the sixth, and partly over and partly under the eighth small cylindrical tube, all which tubes are full of water. The direction of the flame, until it reaches the last-mentioned tube, is shown by the dotted curved lines and arrows. When it has reached that end of the furnace, it is carried by the flue, O, to the other side of a wall, built beneath the main cylinder A, in the direction of its length, and the flame then returns under the opposite end of the seventh smaller cylinder over the sixth, under the fifth, over the fourth, under the third, over the second, and partly over and partly under the first, when it passes into the chimney. The wall before-mentioned, which divides the furnace longitudinally, answers the double purpose of lengthening the course which the flame and heated air have to traverse, giving off heat to the boiler in the passages, and also of securing the flanges, or other joints, of the frames, employed to unite the smaller tubes to the main cylinder, from being injured by the fire. The ends of the small cylindrical tubes rest on the brick-work which forms the sides of the furnace, and one end of each of them is furnished with a cover, secured in place by screws and a flange, but which can be taken off at pleasure, to allow the tubes to be cleared, from time to time, from any incrustation or sediment which may be deposited in them.

To any convenient part of the main cylinder, A, a tube is affixed, to convey the steam to the steam-engine. In working with such boilers, the water carried off by evaporation is replaced by water forced in by the usual means of a high-pressure boiler, that is, a forcing-pump; and the steam generated is carried to the place intended by means of pipes connected with the upper part of the cylinder A. In the specification, means are pointed out for applying this plan to the boilers of steam-engines already in use, by raising a row of cylinders beneath the present boiler, and connecting them with each other, and with the boiler. Directions are also given for constructing boilers composed of cylinders disposed vertically. In every case the tubes composing the boilers should be so combined and arranged, and the furnace so constructed, as to make the fire now act at right angles to the sides of the boiler, or to embrace the largest possible quantity of their surface. It must be obvious to any one, that the tubes may be made of any kind of metal; but cast-iron is the most convenient. The size of the tubes may be varied; but in every case, care should be taken not to make the diameter too great: for it must be remembered, that the larger the diameter of any single tube is in such a boiler, the stronger it must be made in proportion, to enable it to bear the same expansive force of steam as the smaller cylinders. It is not essential, however, to the invention, that the tubes should be of different sizes; but the upper cylinders, especially the one which is called the steam-cylinder, should be larger than the lower ones, it being the reservoir, as it were, into which the lower ones send the steam, to be thence conveyed away by the steam-pipe. The following general directions are given respectning the quantity of water to be kept in a boiler of this construction; viz. it ought always to fill, not only the whole of the lower tubes, but also the great steam-cylinder A, to about half its diameter, that is, as high as the fire is allowed to reach; and in no case should it be allowed to get so low as not to reach the vertical neck of the boiler, which joins the smaller cylinders to the great cylinder, full of water, for the fire is only beneficially employed when applied, through the medium of the interposed metal, to water, to convert it into steam; that is, the purpose of the boiler would in some measure be defeated, if any of the parts of the tubes which are exposed to the direct action of the fire, should present a surface of steam in their interior, instead of water, to receive the transmitted heat. This muff, more or less, be the case, whenever the lower tubes, and even a part of the upper, are not kept filled with the water.

Respectning the furnace for this kind of boiler, it should always be so built as to give a long and warming course to the flame and heated air, forcing them the more effectually to strike against the sides of the tubes which compose the boiler, and so to give out the greatest possible portion of their heat before they reach the chimney. Unless this be attended to, there will be a much greater wafte of fuel than necessary, and the heat communicated to the contents of the boiler will be less from a given quantity of fuel.

When very high temperatures are not to be employed, the kind of boiler just described is found to answer very well; but where the utmost force of the fire is desirable for producing the most elastic steam, the parts are combined in a manner somewhat different, though the principle is the same. In the Philosophical Magazine, vol. xxvii. p. 40, are a description and drawing of a boiler of this kind, two of which were erected in 1803 at Medirs. Meus's brewery.

In every case Mr. Woolf uses two safety-valves, at least, in his apparatus, to prevent accidents; a precaution which cannot be too strongly enforced, as it may happen, when
but one is employed, that by some accident it may get locked, and the engine and people about it be exposed to the danger of an explosion.

In those engines of Mr. Woolf's which we have seen, he employs boilers like the one described, viz. with two small tubes beneath, which are full of water, and exposed to the immediate action of the flame, communicating by perpendicular necks or branches with the large cylinder above, which has water in the lower part, and steam in the upper. The only difference from what we have above described is, that the lower and upper tubes are placed in the same direction, instead of being at right angles to each other, as in the flame, and the flame, instead of being inclined, is rather inclined upwards. The metal of these tubes is made very thick, with a view to strength and durability.

The idea of making boilers for raising strong steam, by a number of small tubes, which can be made stronger than one large vessel, is not original with Mr. Woolf; Mr. Blakney, of whom we have before spoken, having proposed it in a small tract which he published in French, at the Hague, in 1796. But his tubes were to be placed over each other in an inclined direction; and the water being admitted at the upper end, ran down within the heated inclined tubes, and became converted into steam.

**Woolf's Regulating Steam-Valve.**—Besides the common safety-values, Mr. Woolf has also introduced a valve of a new construction into the flame-pipe itself, to regulate the quantity that shall pass from the boiler. In fact, it is a self-acting flame-regulator, and extremely ingenious. A (fig. 6.) is a part of the great or flame cylinder of one of Mr. Woolf's boilers; B B, the neck or outlet for the flame, furnished by the box; C, the flame-pipe is tied to the neck of B B, by the flanges a a. The top or cover of the flame-box C, marked with the letter D D, is well secured in its place, and has a hole through it for the rod of the valve to pass through; and the interior of the hole is formed to a box to hold a stuffing, and make the rod work up and down, flame-tight; the stuffing being kept in its place by means of a collar, screwed down in the usual way, as shown in the figure. By means of a pin δ δ, and the two vertical pieces e e, the stuffing-valve is made fast to m, which is a collar contiguous to the inner end of the flame-tube. The cover covers the inner end of the collar o o, which is made fast to the flange a a, and descends into the neck of the boiler, forming a barrel, in which the cylinder fits close. The cylinder, n, is open at bottom, having a free communication with the flame in the boiler A A; and it has three vertical flaps cut through the sides, one of which, S, is shown in the plate. The lumen of all these flaps or openings is equal to the area of the opening of the seat or collar o o, in which the cylinder, n n, works.

When the flame acquires a sufficient degree of elastic force to raise the valve, that is, the cylinder n n, with its cover m m, and the rod R R, together with whatever weight the rod may be loaded, then the openings S, rising above the flame-tight collar or seat o o, allow the steam to pass into the flame-box C C, and to flow off to the engine through the pipe N N. But the quantity of steam that passes is proportioned to the elastic force it has acquired, and the weight with which the valve is loaded; because the rise of the openings S, above the collar o o, will be in that proportion.

This valve may be loaded by applying weights in any of the usual methods; but Mr. Woolf prefers the one shown in the drawing, in which the upper part of the rod, R R, is joined by means of a chain to a quadrant of a circle Q Q, with an arm projecting from it, as represented in the plate, for the purpose of carrying a pendulum weight Z Z, that admits of being moved nearer to or farther from the centre of the quadrant, according as the pressure of the valve is wished to be increased or diminished.

As the valve rises, the weight moves upwards in the arc n n, giving a continually increased resistance to the farther rising of the valve, proportioned to the horizontal distance of the weight from the centre of Q Q, of which the weight attains a continual increase by its rise in the arc, and the flame proceeds in the horizontal distance measured by the line Q Q, passing through the centre of the weight by perpendiculars from the horizontal line.

Thus, if the weight Z Z presses down the valve n n, with a force equal to 20 lbs. on the square inch of the aperture in o o, in its present position, when it rises to the position at s, it will press with a force equal to 30 lbs.; and at r, with a force equal to 40 lbs. on the square inch; so that the rod, Z Z, may be made to serve at the same time as an index to the person who attends the fire, nothing more being needed for this purpose than the descriptions given by the end of the rod Q Q, by experimental trials. In the side of the flame-box C C, there is an opening N N, to allow the steam to pass from it by a pipe to the flame-engine.

It is plain that the adjustment of the positive pressure on this valve can be determined by sliding the weight, Z Z, of the pendulum to a greater or less distance from the centre of motion. Again, to adjust the rate of the increasing forces, so as to correspond with the increasing force of the flame, the radius of the quadrant, Q Q, must be proportioned to the atmosphere of the valve, radius of the open flaps S S, so that the ascent of the weight, Z Z, in its quadrant will be correspondent to the varying pressure. This adjustment must be made as nearly as it can be done before the valve is fixed, and to bring it afterwards to an exact regulation, the chain is attached to the rod, R R, by a nut and screw; by means of which, any part of the arc can be used that is found most correspondent with the varying pressure, because the rate at which the resistance of the lever increases is more rapid when the pendulum is near to the perpendicular, than when it approaches the horizontal position. The valve is shown in the side of the cylinder narrower at the lower part of the cylinder, instead of being parallel.

**Edelcrantz's Safety-Valve.**—The chevalier Edelcrantz contrived a safety-valve, some years ago, which has the same properties as Mr. Woolf's, and is worthy of notice, as being more simple in its construction. A small brass cylinder is fixed on the boiler, and fitted with a piston, which moves with very little friction, in order that it may descend by its own weight, after it has been raised up, without, however, permitting the steam to pass between it and the cylinder in any quantity. The lower part of the cylinder communicates with the boiler, and the upper part is closed by a small cover screwed on to it, and perforated with a hole, through which the piston-rod paffes easily. This cover serves the double purpose of guiding the rod, and preventing the piston from being blown out. The piston-rod is furnished with a shoulder, which serves to support different weights which are placed upon it, and they can be changed at pleasure. The side of the cylinder is pierced with holes opening to the air; the holes are very small, and placed above each other at the distance of about a line, but...
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This distance, as well as the number of them, is a matter of indifference.

To give an idea of the effect of this small apparatus, let us suppose the piston lowered, and loaded with any weight, and that a fire is kindled under the boiler. When the vapour has acquired sufficient elasticity to raise the weights, the piston will ascend and have raised the first hole; if the steam were escape, it will remain in that position, and in a state of oscillation; if not, it will ascend above the second, third, &c. hole; and if the intensity of the fire is sufficiently strong, above the last, which must be made large, that, by giving the proper means of escape to the vapour, all accidents may be prevented. It is here evident, that though the greater or less elevation of the piston, as well as the number of the holes open, depend on the variations and different intensities of the fire, these variations, however, have no influence on the interior heat, and the elasticity of the vapour contained in the digester, since their force is always proportioned to the weight with which the piston is loaded, and which is constant. This safety-piston seems likely to afford, for delicate experiments, greater exactness than the usual safety-valves hitherto employed, with levers charged with weights; for in the whole course of the space which the cylindrical piston passes over in ascending, the state of the elasticity of the vapour is the same; whereas, when the conical valve is common use, none rises up by nothing prevents whether or how much the present state of the vapour fur- passes the first effort it made to open the valve. Besides, the diameter of the piston being once known, the force of the vapour requisite for each experiment can be easily regulated and determined: if we suppose, for example, that the lower surface of the piston is 4/9 of a square inch, each ounce of weight placed on the shoulder of the piston-rod will be equivalent to the pressure of a pound on each square inch of the surface, and so on in proportion. As this pressure then remains constant, the experiment will be more exact, and consequently more comparative.

The application of this piston to the boiler of the steam-engine needs no farther explanation, except that, in this case, the diameter of the piston must be considerably increased. It seems here to offer the same advantage of greater uniformity in the force of the steam, especially if the motion of the piston be employed to regulate the fire of the furnace, and to prevent the useless dispersion of the vapour, by preventing an excess in the intensity of the fire. The following apparatus may be used for this purpose. Let the aperture of the due for the current of air which maintains the combustion of the fuel be provided with a register, which, by rising and falling, will open or shut that passage of air: if the motion of the safety-piston be combined by any means with the register, in such a manner that when the former ascends, the latter descends, so that when the piston is at its greatest elevation, the register shall be entirely shut, it is evident that since the heat produced depends on the access of the air, the elasticity of the vapour, being determined by the weight on the piston, will not only remain within the bounds prescribed for it, but will regulate itself, by preventing any more air from entering the furnace than is necessary to maintain its force. A figure, representing this useful apparatus more minutely, may be found in the 17th volume of the Philosophical Magazine, p. 162.

Before quitting the subject of double-cylinder engines, we shall notice some others beside those of Mr. Hornblower and Mr. Woolf.

Messrs. James and John Robertson had a patent for one in 1800. The proposed object of the double cylinder was to have that portion of the steam, which in the best constructed steam-engines escapes past the sides of the piston in the time of working, and is lost without producing any motive effect whatever, so Mr. Robertson's intention was to prevent so great a quantity of steam from escaping, and in making the steam, which actually did escape, act on another piston, and add to the power of the engine. There are two steam-cylinders, with a piston fitted to each; the one cylinder of a smaller, and the other of a larger size. These two cylinders act together in producing the effect, and are furnished with a condensing vessel and air-pump, similar to other engines. The same patent contains the description of the smoke-burning furnace, which has been very extensively used.

Mr. William de Vereell obtained a patent in 1805, for improvements in the steam-engine. He proposes to have two working cylinders, placed near to one another, each having a pipe of communication, with a large vessel, in which the steam, after passing from the small cylinder, is suffered to expand itself, before entering the large cylinder. The pistons in the two cylinders work alternately up and down by means of valves or cocks, opening and shutting as in the common engine. Suppose the small piston has just made a stroke, and a passage is opened to the steam-vessel at the end of the stroke; at a certain beginning to work the engine, the vessel will be full of steam of about 18 lbs. pressure, admitted from the boiler, but afterwards will only be supplied by the steam thrown into it from the small cylinder. The vessel should be about twenty times larger in capacity than the smallest working cylinder; and the larger it is, the more regular will be the pressure on the great piston, which is worked by the steam coming from the steam-vessel. If the steam in the boiler be of 54 lbs. pressure per square inch, the ratio of the two working cylinders may be as 1 to 3, for then the smaller one will supply the larger with steam of about 18 lbs. pressure; the proportion, however, may be varied, though these are thought best by the patentee. The improvements here are represented to consist in the steam going from the smaller working cylinder to the steam-vessel, and then from the steam-vessel to the larger working cylinder, from which it is afterwards drawn off, and condensed. By these means the engine will be very regular in its operations. Suppose the steam in the boiler is at 54 lbs., the smaller cylinder will, at the end of the stroke, be full of steam of the same or nearly the same force; and the steam-vessel being full of the steam delivered to it by the former stroke of the small cylinder, at about 18 lbs. pressure, the communication is opened between this vessel and the smaller cylinder, and the steam in each of these will be brought to nearly 20 lbs. pressure, which steam will be used in the great cylinder at the next stroke. But at the end of each stroke of the pistons, before the opening is made between the smaller cylinder and the steam-vessel, the steam in the smaller cylinder will be, as before stated, at about 54 lbs.; in the steam-vessel it will be at about 18 lbs., and in the larger working cylinder at about 18 lbs. also. Hence the medium pressure on the piston of the smaller cylinder will be about 55 lbs. on the inch, while the medium pressure of the steam on the piston of the great cylinder will be about 19 lbs. on the inch; for it will be about 20 lbs. at the beginning, and about 18 lbs. at the end of the stroke. If the steam-vessel be made larger, the difference at each end of the stroke will not
not be so great. If the steam was let out at 5 lbs. from the smaller cylinder to the open air, there would be but 39 lb. upon each inch of the piston, in consequence of the re-action of the atmosphere, equivalent to about 15 lb. per inch; thus, by letting the steam pass from the smaller cylinder to the steam-vessel, instead of letting it out to the open air, it loses about 4 lbs. on the inch of the small piston, but it gains about 12 lbs. on the inch of a piston three times as large; and there being but half the steam required in the common way to condense, there must of necessity be a considerable gain. If the friction and loss of force be equal to 6 lb. on the inch on the piston of the smaller cylinder, there will be about 30 lb. on the inch next power, when the larger one will work about 12 lb. on the inch. Here too, if the large cylinder, or piston, or air-pump, or condenser, should be out of order, the small piston may still be worked, by diffracting the large piston from the beam; on the other hand, if the smaller piston be out of order, the large one may still be worked, while the other is diffracted. The steam-vessel is to be made of wood, that it may transmit the heat slowly; and the cylinders may be placed within it, if found convenient.

We have examined two engines of Mr. Deverell’s which worked with great regularity, but the nature of the work they were performing did not admit of any accurate estimate of their power. The quantity of fuel they consumed was but small. We are disposed to think the addition of the steam-vessel has prevented the engine from the advantage of regulating the pressure, provided the heat is kept up; and for this purpose, the steam-vessel is in one of the engines we speak of was included in the boiler, and we think would, in that case, receive a confluent addition of heat to the expanded steam within it, which we believe is essential to all these kinds of engines. See the specification at large in the Repertory of Arts, vol. viii. p. 81.

Messrs. Fox and Lean also have a patent, dated Dec. 10, 1801, for improvements on steam-engines, the principal part of which is a double-cylinder engine, very much resembling those which we have described. See the Repertory, vol. xxii. p. 200.

Application of Reciprocating Engines to produce a rotative Motion for turning Machinery.—We have hitherto considered the steam-engine as being confined to the operation of working pumps for raising water; except in the flight notice which we have taken of the application of the crank to the atmospheric engine. This was a thing so obviously in imitation of the foot-lathe, as to be scarcely considered an invention; but the difficulty of applying it to use arose from the want of regularity in the action of the old engine. An engine to work a crank, must at all times make exactly the same length of stroke; and to perform well, all these strokes must be performed in an equal period of time. The old engines had very little exactness in either of these particulars. From the nature of the detent which opened the injection-cock, and the great friction of turning it, the degree to which it was opened was not constantly the same in the succeeding strokes; and a very small difference of opening would materially influence the quality of injection, and consequently produce a greater or less vacuum, and velocity with which the piston would descend. The boilers also of the old engines were always made too small, so that the leaf alteration in the intensity of the fire made the engine vary its speed.

At present, in all countries the atmospheric engines are made to work machinery by means of a crank, and perform very well, but they are lightly loaded, and move very quickly. The steam in the boiler is made much stronger than formerly, to enable it to fill the cylinder with a sudden puff, and thus to displace the air and water in an instant, because the rapid motion of the piston will not allow sufficient time for the discharging to be performed with weak steam, as is usual. All these circumstances reduce the performance of the engine with respect to coals, and the consumption is very great in comparison with the work they perform. Such engines act very well when the work or resistance is constantly the same throughout the day; but the engine cannot work regularly, except when the counter-weight of the connecting rod is equal to half the descending force of the piston, so as to make the stroke upon the crank of equal force in ascending and descending. In breweries, and those works which demand attention to varying resistance, this cannot apply: for instance, when the machinery for grinding is disengaged, or thrown off, if something does not operate to retard the effect of the counter-weight, the engine will increase in its velocity beyond all bounds, so as to work itself to pieces; and as the only remedy is to check the quantity of steam at the returning stroke, the discharge of the air will be interrupted, and the engine must stop. Mr. Watt’s single engine accommodates this circumstance, from the mode of discharging being constant, and not possible to be effectual by the work applied to it, whether it be uniform or variable; hence, to lessen the momentum of the counter-weight, it is only to check the entrance of the steam by any constrivance that will prevent the steam from entering at above the piston, from opening to its greatest limits.

Mr. Watt, for some years after the first introduction of his engines, was so fully occupied in substituting them for the large atmospheric engines at mines, where the expense of fuel was threatening to put a stop to their proceedings, that he found no leisure for new speculations; and although the advantages of applying engines on his principle to agricultural machinery had early occurred to him, he did not seriously set about reducing his ideas to practice until the year 1778 or 1779. In the first model he then made, in order to equalise the power, he employed two cylinders, acting upon two cranks fixed upon the same axis, at an angle of 180° from each other, and a weight was placed upon the circumference of the fly-wheel at an angle of 120° from each of the cranks; which weight was to be so adjusted, as to turn the wheel when neither of the cranks could do so, and consequently to render the power nearly equal. This model performed satisfactorily; but Mr. Watt having neglected to take out a patent immediately, the essential part of the contrivance was communicated, as we are informed in the Edin-burgh Review, by a workman employed to make a model, to the persons engaged about one of Mr. Walshbrugh’s engines, of which we have before spoken, and a patent was taken out for the application of the crank by the engineer there employed. This did not deter Mr. Watt from proceeding; and without attempting to dispute a patent which, so long as it continued attached to the common atmospheric engine, could not rival him, he set about other modes of effecting the same thing, and took out a patent for several new methods of applying the vibrating or reciprocatting motion of steam-engines to turn a coupled rotary motion round an axis, one of which was that beautiful contrivance of the revolving motion of one wheel round the other, called the fun and planet wheels, from the resemblance to the motion of those laminaries. Mr. Watt’s patent is dated Otober 1783, and entitled, a new method of applying the vibrating or reciprocating motion of steam-engines to produce a continued rotary or circular motion. It contains six different methods; but the two which have been since brought into use are
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are the crank, and fun and planet wheels. The crank is applied in the best manner to produce a regular motion, when a single acting engine is the moving power: this was to apply an iron wheel on the end of the axis of the fly-wheel for a crank, and with a pin projecting from it, to which the connecting rod is jointed: one half of the wheel is made solid, of cast-iron, in order to be heavy on that side in which the pin is fixed, in or to be moved by that side in the return stroke of the engine; the other half of the wheel is made light, that it may not oppose this weight.

Soon after this patent, Mr. Watt erected some engines in London at the large breweries; the first was at Mr. Goodway's, a spirited encourager of improvements, and the next at Mr. Whitbread's. A sketch of the latter engine, which is still working, is given in our plate Porter-Brewery. In these engines he employed the fun and planet wheels, and used a maltese connecting rod, of sufficient weight to actuate the fly during the returning stroke, for these engines had not the advantage of the double action.

Double-acting Steam-Engines.—The advantage of a double-acting engine, which shall urge the machinery equally in ascending and descending, is obvious. The first double-acting steam-engine was proposed in 1779, by Dr. Falcet, who published an account and description of an improved steam-engine, which will, he says, with the same quantity of fuel, and in an equal space of time, raise double the quantity of water raised by any lever-engine of the same dimensions; but he does not appear to have proved the assertion, or constructed even a working model of this proposed engine, which was on Newcomen's principle. The chief improvement which he suggests is to use two cylinders, into which the steam is alternately admitted by a common regulator, which always opens the communication of the steam to one, whilst it shuts up the opening of the other. The piston-rods are kept (by means of a wheel fixed to an arbor) in a continual ascending and descending motion, in the same manner as the rods of the common air-pump, by which they move a common axle, to which is affixed another wheel, moving the pump-rods in the same alternate direction as the piston-rods, by which alternate motions of the two pistons the pumps are kept in constant action. Since the improved engines of Mr. Watt have been introduced, this method of combining the alternate action of two single engines has been applied to work machinery. We have seen both the atmospheric engine and the single engine of Mr. Watt working in this manner, but his double engine is much preferable. Mr. Watt saw that this was necessary, in order to perfect the application of his steam-engine; he therefore applied the power of the steam to press the piston upwards in its cylinder as well as downwards, by forming the vacuum alternately above and below the piston, and the counter-weight then becomes unnecessary. The only change in the machine beside the arrangement of the valves and their mechanism, was in applying a double chain to the arch-head of the beam, in the same way that the pumps of old extinguishing engines were worked; or he employed a rack and fector at the end of the beam.

This he called the double engine, as in fact it doubled the power exerted within the same cylinder. He had long had in his mind the idea of this improvement, and had even produced a drawing of it to the house of commons, in 1774, at the time he procured the act to prolong his original patent for 25 years; but the first he executed was, we believe, at Soho, in the year 1781 or 1782, and the first public exhibition of it at the Albion mills a few years later.

About the same period, finding double chains, or racks and fectors, very inconvenient for communicating the motion of the beam, he invented and applied what has been called the parallel motion, one of the most ingenious and most perfect contrivances in mechanics. To prevent irregularities in the speed of the engine, arising from variations in the quantity of power used at different intervals in the works to which it was applied, he made an application of the centrifugal force of what is called the governor (before used in wind-mills), to regulate the admission of the steam; by this means keeping the engine always at an uniform velocity, and diminishing the consumption of steam, in proportion to the power exerted. This gave the finishing stroke to the perfection of the motion of the machine, and rendered its regularity nearly correspondent with that of the pendulum of a clock. These inventions are detailed, among many other contrivances, relative both to steam-engines and the application of their power, in two patents, dated 1785 and 1784. The steamers are highly ingenious; a few may have been first ideas, not reduced to practice, and others were no doubt inferred for the purpose of guarding against evation.

Miffet's, Boulton and Watt's Double-acting Engine for turning Mills.—Plate VI. contains a general elevation of the whole engine, and Plate VII. fig. 1. is a section of the cylinder, inclosed in its steam-cake or jacket, the outside of which is coated with platter, to keep in the heat; the internal structure will be described hereafter: a is the piston-rod, connected to the great working beam B C E, by a system of levers: C D E. Each of these levers consists of a parallel motion, the property of which is, that the rectilinear motion of the piston-rod, a, is preserved, though the end, C, of the beam describes an arc of a circle when it rises and falls upon its centre of motion, B. At the opposite end, E, of the beam is jointed the connecting rod D, and at the lower end of this is Mr. Watt's contrivance for communicating the force of the steam-engine to any machine of the rotatory kind. G represents the rim and arms of a very large and heavy cast-iron fly-wheel; on the extremity of its axis is fixed the concentric toothed wheel H, called the fun-wheel. The connecting rod, D, is a strong and stiff iron rod, D y of sufficient weight to balance the piston: to the lower end of it, a toothed wheel, I, is firmly fixed by three bolts, so that it cannot turn round. This wheel is called the planet-wheel, because it revolves round the fun-wheel; it is of the same size and in the same vertical plane with the wheel H, and an iron link or strap (which cannot be seen here, because it is on the other side of the two wheels) connects the centres of the two wheels, so that the one cannot cut the other. The engine being in the position represented in the figure, to explain the action of this movement, suppose the fly, G, to be turned once round by any external force, in the direction from G towards K; it is plain, that since the toothed wheels, being kept together by the link, cannot quit each other, the outer half of the fun-wheel (that is, the half farthest from the cylinder) will work on the inner half of the planet-wheel I, so that at the end of the revolution of the fly, the planet-wheel must have arrived to the top of the fun-wheel H, because the circumferences of the wheels are equal, and the outer end, E, of the beam must be raised to its highest position. The next revolution of the fly will bring the planet-wheel, and the beam connected with it, to their first positions, and thus every two revolutions of the fly will make a complete period of the beam's reciprocating movements. Now, instead of supposing the fly to drive the beam, let the beam drive the fly, the motions must be precisely the same, and each ascent or descent of the piston will produce one revolution of the fly. For
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For instance, when the piston-rod, \( a \), is caused to ascend by the preflure of the steam beneath its piston, it raises one end of the beam and depresses the other; and by the communication of the connecting rod \( D \), causes the planet-wheel \( I \), to turn the wheel \( H \), and the fly-wheel, round with a double velocity. As soon as the piston-rod arrives at the end of its stroke, it receives a new impulse, which brings it down again, and consequently raises the connecting rod \( D \), and planet-wheel \( I \), so as to continue the motion of the wheel \( H \), and fly-wheel \( G \), always in the same direction. The use of the fly-wheel is to acquire an impetus from the force communicated to it, at the time that the centre of the planet-wheel, \( I \), is on the same horizontal line with the centre of the sun-wheel \( H \), at which time the connecting rod exerts all the force of the engine upon the wheel \( H \), to turn it round. This momentum is preserved by the rapid motion of the fly-wheel, which continues to turn all the rest of the machinery, when the planet-wheel, \( I \), is at the top or bottom of its motion, for the centres of the two wheels being in a line with the connecting rod, it has no tendency to turn them round.

To describe the manner in which the power of the steam is given to the piston-rod \( a \), we must turn to the section in Plate VII., fig. 1, where \( A \) is the jacket of steam-cape containing the cylinder, which is of cast-iron, and truly bored; it is closed at top by an iron lid \( l \), screwed on by screw-bolts, passing through a projecting rim or flange at the top, and a similar flange is formed at the lower end of the cylinders, to fall on the bottom. In the end, the top lid is a stuffing-box \( L \) for holding a packing of hemp, through which the piston-rod, \( a \), passes, perfectly air and steam tight; \( 20 \) is the piston, packed with hemp in a channel round its edge, so that the packing lies between its circumference and the inside surface of the cylinder; and while it can move up and down in the cylinder easily, it will not allow any steam to pass by it. The piston is fitted to the rod, \( a \), with a cone, and fast keyed in: the cylinder has a flange or projecting ring round it, a little below the top flange, by which it is held into the jacket \( A \), which is constantly supplied with steam from the boiler of the engine, by a small pipe branching off from the steam-pipe.

The steam-pipe cannot be seen in the elevation, except by the small dark circle near \( g \); and in fig. 9, it is marked as it introduces the steam from the boiler, at all times, through a throttle-valve, \( 35 \), into a box \( g \), called the upper steam-box. In the bottom of this box is the upper steam-valve, which being opened by depressing the end of the lever \( 7 \), admits the steam to the short passage \( 14 \), which leads to the top of the cylinder. A branch, \( 13 \), descends perpendicularly from the steam-pipe, just before it enters the upper steam-box, and conveys steam to the lower steam-box \( 8 \); and in the bottom of this is a valve, which can be opened by lifting the end of a lever, \( 10 \), to admit the steam into the passage \( 15 \), which leads into the bottom of the cylinder. These two valves govern the entrance of steam into the cylinder; and they both open upwards.

The valves for carrying off the steam are situated in two other boxes, \( b \) and \( k \), in which a vacuum is always maintained by their open communication with the condenser \( M \), by the exhausting-pipe \( 13 \), which descends from the upper box \( b \), and where it passes by the lower box \( k \), has a small branch leading into it.

These two exhausting boxes are situated immediately beneath the passages, \( 14 \) and \( 15 \), which lead to the top and bottom of the cylinder, and the exhausting-valves are situated in the horizontal plate of the partition between the boxes and the passages, in the same manner as the steam-valves are in the partitions between the steam-boxes and the steam passages, as is clearly shown in fig. 3. On opening the upper exhausting-valve, by depressing the lever \( 8 \), the steam from the top of the cylinder will be drawn off to the condenser; or by elevating the lever \( 9 \) (fig. 2.), the lower exhausting-valve will be opened, and the steam will pass off from the lower part of the cylinder to the same end.

The steam and eduction-valves, \( 7, 8, 9, 10 \), are opened and shut by the levers called spangers, whose handles, \( 1 \) and \( 2 \), are alternately moved by the plugs fixed to the piston-rod of the air-pump \( N \). This part of the machinery has been called the hand-gear, because it is so contrived that the steam and eduction-valves can be worked either by the hand or by the piston of the air-pump.

The valves are connected in pairs to levers upon the axle of the two handles \( 1 \) and \( 2 \), which are actuated by the pins \( f \) and \( 24 \), projecting from the rod, \( f \), of the air-pump, and this arrangement is this: the lower steam-valve \( 10 \), and the upper exhausting-valve \( 8 \), are connected by rods with levers upon the axle of the lower handle \( 2 \), and when that handle is depressed it will open both those valves at once, to admit steam below the piston, and exhaust it from above, which will cause the ascent of the piston. A lever and rod \( 6 \), (see the elevation) are applied to the axis of this handle, with a sufficient weight in the ciften to cause the handle to fall and open the valves suddenly; but when the valves are to be kept shut, the handle, \( 2 \), is held up by a catch, and dentet \( 34 \), the end \( 4 \), having a hook to receive the catch, and detain the handle when lifted up, as in the figure.

In the same manner, the upper steam-valve \( 7 \), and the lower exhausting-valve \( 9 \), are united by rods to levers upon the axis of the upper handle \( 1 \); and when this handle is raised, as in the figure, it opens both valves at once, so as to admit the steam above the piston and exhaust it from beneath it, as is shown by the arrows in the section, which will cause the piston to descend.

Like the former spindle, a lever, \( 5 \), and rod are applied to it, with a weight which will lift up the handle, \( 1 \), and open the two valves; but when the handle is depressed, so as to shut the valves, it is held down by the catch entering the hook, \( 3 \), of the dentet \( 34 \). As this dentet moves upon a centre-pin, it must be observed, that when one lever catches into the hook it pushes back the dentet, and this motion releases the other catch from the hook at the opposite end of the dentet, so that moving one handle to shut one pair of valves releases the catch, and the weights immediately open the opposite pair of valves.

The exhausting-pipe, \( 13 \), descends to the condenser \( M \), which is a cylindrical vessel of cast-iron, immerced in the cold water of the condensing ciften \( L \); it communicates by the valve \( m \), with the air-pump \( N \), which has valves in its bucket opening upwards, and is covered by a lid, through which the rod paffes in a stuffing-box ; also at the top of the pump is a short pipe of discharge, opening into the hot-well \( n \), and this has a valve to prevent the return of the air and water into the pump.

All these parts are exactly the same as those of the single engine, before described, except the injection-cock \( 16 \), which is constantly running a small jet of cold water into the condenser, when the engine is at work. There is no necessity for an injection-valve in the double engine, and the use of the cock is only to regulate the quantity, and to stop it when the engine is not at work; it is moved by a handle \( 17 \), and there is a divided plate and index, to shew the degree of opening.
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The cylinder is bolted down to two strong beams, which cross over the top of the condensing cistern L, and these are united at the ends to two vertical polls S, which are framed into another piece situated beneath the cistern, and supported upon a pier of brick-work R: by this means the whole weight of the water in the cistern is applied to hold the cylinder firmly down. X are beams which support the flain of the beam-centre, by bearing up the floor F, on which the centre bearing rests; and the narrow dark line up the middle of the frame K, is a large iron bolt, which ties the frame down to the long groundills, on which the cistern rests, and with which the beam T, for the centre of the fly-wheel, is connected by oblique legs and tie-bolts: by this means the external walls, W, W, are relieved from any material strain occasioned by the working of the engine. X X is the staircase to ascend to the beam-floor. The boiler is not represented, but may be considered the same as that of the single engine.

Operation of the Double Engine.—Supposing every thing in the position of the fiction, the operation of the engine is as follows. When the water in the boiler is heated by the fire made under its bottom, the heat which enters into combination with the water causes it to expand, and form steam: in this state it rises and fills the boiler; and thence passing through the pipes 21, enters the upper steam-box g; it then passes into the cylinder; and by the descending branch, 12, of the steam-pipe, enters and fills the lower steam-box 2. Before the engine can be worked, the steam must be heated, until it is expanded so much, that it will rush forcibly out of the boiler when permitted.

The person who attends the engine must now open all the four valves at once, by elevating the handle i, and depressing the handle 2; this admits the steam from the boiler to pass through the boxes and the cylinder to the condenser, when it rushes through the pipe 13, into the condenser M, and the air therein contained, through the valve n, and the valves in the bucket of the air-pump, which it opens, and passes into the cistern m, through the discharge-valve, where it is open to the atmosphere, the lid of that cistern being only laid on, and not setting tight. This operation (called blowing through) being continued for a few seconds, expels all the air from the condenser, and fills it with hot steam. All the four valves are now closed, by depressing down the upper handle i, and lifting up the lower handle 2; and the injection-cock 16, of which 17 is the handle, is opened; this allows a small stream of cold water from the condensing cistern L, to enter into the condenser, and condenses the steam or cools it, when it instantly contracts into the same space it originally occupied in the boiler, before it was heated. As the valve, m, closes, to prevent the return of the atmospheric air, a vacuum will be caused in the condenser, because there will be nothing in it but that small quantity of water produced from the steam, and the cold water injected into the condenser.

The engine-man now opens the upper condensing valve 8, and lower steam-valve 10, by allowing the lower handle, 3, to fall down. The communication to the condenser being thus opened, the mixture of air and steam in the upper part of the cylinder will expand itself into the condenser through the passage 14, and valve 8, by the exhausting-pipe 15; as it occupies more space than it did before, it will be considerably rarefied, and press lightly upon the upper side of the piston. The steam from the boiler entering through the open valve, 10, is all the while preying with its full force against the lower side of the piston, and will perhaps, now a rarefaction is made above it, overcome the resist ance of the work and friction, and cause the piston to ascend, the air-pump rod and bucket moving with it. When the pin 24, upon this rod, reaches the handle 2, it raises it up, and shuts the lower steam-valve 10, and the upper exhausting-valve 8; and by means of the catch preying back the hook at the lower end of the detent 4, it relieves the catch of the upper handle from the hook 3, of the detent; in consequence of which, the weight applied to the lever 5, throws up the handle 1, and opens the upper steam-valve 7, and lower exhausting-valve 9, while the hook 4, of the detent, receiving the catch of the lower handle 2, holds it up. This is the situation represented in the section in fig. 1.

The operation is now reversed; the steam from the boiler going through the valve 7, and passage 14, into the cylinder above the piston, as shown by the arrow, fig. 1; and that steam which is beneath the piston going through the passage 15, and valve 9, to the condenser, where the steam will be condensed, and a vacuum will be formed beneath the piston: the steam now preys it down, moving the beam, and turning the fly-wheel and other machinery which it has to drive. When the piston is at the bottom, the pin, f, on the air-pump rod arrives at the handle 1, and preys it down; this shuts the upper steam-valve 7, and lower exhausting-valve 9; and when they are completely shut, the catch of the upper handle, in entering the upper hook of the detent 4, disengages the lower hook thereof; and the weight 6, which is applied to the lower handle 2, immediately throws open the lower steam-valve 10, and the upper exhausting-valve 8: the steam entering at the lower passage 15, the piston will be driven up again.

At each stroke of the engine, when the piston rises, the valve in the bucket of the air-pump will shut, and all the air and water contained above the bucket will be lifted through the valve, n, into the cistern or hot well; at the same time, a vacuum being made beneath the bucket, which is more perfect than that in the condenser, the valve, m, will be opened by the water and air in the condenser, which will enter the pump. On the descent of the piston, and air-pump bucket, the valve m, and the discharging-valve, n, will be shut, because the pressure which opened them is removed; and the water and air in the pump preying upon the valves in the bucket will open them, and pass through the bucket as it descends. At its return, it raises and discharges the water and air above it at the valve m, as before.

In this manner, when the engine has made two strokes, all the air which was contained in the cylinder, and mixed with the steam at the commencement of the operation, which was the only part from which it could not be expelled by blowing through, will be pumped out. The operation of the engine is now more perfect; the instant the exhausting-valve is opened, so as to establish a communication from the cylinder full of steam to the condenser, the elasticity of the steam causes it to rush through the valve, down the pipe 13, into the condenser; when it arrives there, it meets the steam of the injection-water, which condenses it, the remaining steam in the cylinder following it surprisingly quick; and in an instant, an almost perfect vacuum is formed in the cylinder, so that the steam acts with its whole force upon the piston to give it motion, all resistance upon the other side being removed.

The air-pump has now only to draw off from the condenser the water injected into it, the water produced by the condensed steam, and that small quantity of air or gas which goes from the boiler with the steam, and will not be condensed by the cold water. These are delivered by
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by the air-pump into the hot-well, $a$, from which the air escapes; and the water, which still continues hot, runs off, when at a certain level, by a waste-pipe, which is not represented.

The water which is boiled off in steam from the boiler, is conveyed from the hot-well by means of a small pump, $p$, in the elevation, which draws the water from it by a pipe $o$, conducted up the side of the great frame $k$, which stands at the end of the condensing cistern $l$, and supports the bearing for the centre of the great beam. The water is conveyed from the pump by a pipe, to a cistern placed at the top of a vertical pipe, which descends into the boiler. The top of this pipe is closed by a valve in the cistern, which valve is raised by means of a lever, and the other end has a wire hooked to its going through a small stuffing-box into the boiler, where a flange is hung to it. This flange is balanced by a weight suspended at the other end of the lever, so that when the flange is covered with water, the weight keeps the valve shut, and prevents any water getting down into the boiler; but as the water sinks in the boiler by the evaporation, the weight of the flange overcomes the weight, and opens the valve: the water in the cistern then runs down the pipe into the boiler, and raises the water therein, and the balance-weight lifts up the flange, so as to close the valve.

The water being constantly supplied with hot steam, which gives out its heat, it would at length render the water surrounding it in the cistern so hot, that it would condense no more. To prevent this, it is constantly supplied with cold water from a pump $o$, worked by a rod $p$, from the great beam. The water from the condening cistern runs off by a waste-pipe at the back of the cistern, but not seen in the figures. The safety-valve is placed in a short pipe fixed upon the boiler, with a lid and a stuffing-box, through which a rod passes to open the valve within, and discharge the steam when the engine is not to be worked any longer. When at work, the valve is pressed down by a lever and weight. If at any time, when the engine is not at work, the steam should be heated, so as to be in any danger of bursting the boiler, the valve will lift up the weight, and allow the steam to escape through the pipe which opens into the chimney.

Other Particulars of the Double Engine. — Mr. Watt's mode of regulating the engine is a most beautiful contrivance, and so perfect, as to put the steam-engine on an equality with a water-wheel, in the regularity of its motion, even when the refraction is very variable. The throttle-valve, which regulates the supply of steam, is placed in the steam-pipe at $25$ (Plate VII. fig. 2): it is a thin circular pipe in the valve, turning on a pivot across its centre, which comes through the pipe, and has a small handle fixed on the end of it; by turning this handle, the spindle and valve within the pipe are turned also. When the valve is set, so that its plane is perpendicular to the axis of the pipe, it nearly fills the circular passage, and offers little steam, if any, to pass by it; but when the valve is turned edgewise, it presents a very small surface, and the steam passes by without obstruction to the steam-box and $i$. By turning the handle of the throttle-valve, the engine-man can at any time regulate the speed of the engine, the friction of the axis being sufficient to retain it as it is placed.

This method of regulation is sufficient for many engines; but when the steam-engine is employed to drive machinery, in which the refraction is very variable, and where a determinate velocity cannot properly be dispensed with, Mr. Watt has applied the conical pendulum, which is represented in the elevation (Plate VI.) at $b$, for procuring uniform velocity. (See also Regulator and Mill-Worke) This regulator has two pendulums, consisting of heavy balls, $b, s$, suspended by iron rods, which move on a common joint, $v$, at the top of the vertical axis $w$, which is put in motion by an endless rope, $g$, passing round a pulley on the axis of the fly-wheel, and round another pulley upon a small horizontal axis, from which, by means of a pair of bevelled wheels, $r$, the motion is communicated to the vertical axis $w$, which is caused to revolve, and carry the pendulum with it. In this motion, their balls, $b$ and $s$, describe a horizontal circle, and the velocity is sufficient to make the balls fly out by their centrifugal force, the arms of the pendulums moving upon their centres: in this motion, the upper ends of the arms $v, w$, draw down a collar, $u$, which slides on the square part of the axis, and operates on a lever $m$, and by another lever $n$, and rod $a$, communicates with the steam or throttle-valve. The action of this beautiful contrivance is this: as the velocity of the fly-wheel increases and diminishes with the quantity of steam that is admitted into the cylinder, let it suppose that too much is admitted; then the velocity of the fly-wheel is increased, and the velocity of the vertical axis $w$, will also increase, and the balls $b, s$, will recede from the axis by the augmentation of their centrifugal force. By this reces of the balls, the extremity, $a$, of the lever is depressed, its other extremity rises, and acting upon the lever $g$, cause the rotation of the throttle-valve to increase, and to close the passage a little, and diminish the supply of steam. The impelling power of the engine being thus diminished, the velocity of the fly-wheel and the flying balls decreases in proportion, and the balls resume their former position, and the engine works regularly.

The advantage of the sun and planet wheels has been alluded to in making the fly-wheel revolve with a double velocity to that which would be produced by a simple crank, by which means a fly-wheel of smaller dimensions becomes sufficient to regulate the motion of the engine. Of late years, this ingenious contrivance has been laid aside in favour of the simple crank, because it has been found that the cogs of the two wheels, when they become worn and loose, act with a disagreeable jerk at every change of the motion from the ascents to the descents. As it is in many cases an advantage to make the fly-wheel revolve with a double or triple velocity, a large cog-wheel is applied upon the axis of the crank, and this turns a pinion of only one-half or one-third of the size, fixed upon the axis of the fly-wheel. Here the fame defect of the jerk, by the loosening of the cogs, will be experienced; but the wheels being larger than can be used in the sun and planet wheels, a greater number of cogs are brought into action, and the weight upon each will be less: also, this form of the engine can be included in less room, because the centre of the large fly-wheel may be brought beneath the middle of the beam.

The power of the engine, when transmitted by the crank, is extremely variable throughout the different periods of the stroke: at first beginning, the crank being in a line with the connecting rod, the force of the piton has no action at all to begin the motion of the joint, $d$, but by turning the handle of the throttle-valve, the engine-man can at any time regulate the speed of the engine, the friction of the axis being sufficient to retain it as it is placed.

A Table
A Table shewing the force which the connecting rod of a steam-engine has to turn round the crank at different parts of the motion. The parts of the engine are supposed to have the following proportions: length of the stroke, 1; length of the beam, 2; length of the crank, 3; length of the connecting rod, 5.

<table>
<thead>
<tr>
<th>Decimal Portion of the Defect of the Piton, the whole Defect being 1.</th>
<th>Degree of the Connecting Rod and Crank</th>
<th>Effective Length of the Lever upon which the Connecting Rod acts, the whole Crank being 1.</th>
<th>Decimal Portion Half a Revolution of the Fly-wheel.</th>
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<tr>
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<td>.0</td>
<td>.0</td>
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<tr>
<td>.05</td>
<td>157.5</td>
<td>.46</td>
<td>.138</td>
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<td>.271</td>
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<tr>
<td>.25</td>
<td>117.5</td>
<td>.89</td>
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<tr>
<td>.3</td>
<td>110.5</td>
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<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

The third column of this table shews the force which is communicated to the fly-wheel, expressed in decimals, the force of the piton being 1.

The above table explains itself by the titles of its different columns, and it is only necessary to remark, that the variations of force are not to be considered as an absolute loss of power, because, when the crank has but light power, on arriving towards the top or bottom of the stroke, the whole force descends proportionally; and, in consequence, the steam has more time to flow into the cylinder, and press upon the piton with a greater power; therefore, what the piton loses in force upon the crank, it makes up in some degree by an increase of its force; and, from moving forward, it consumes less steam than when moving with its whole velocity, and acting with full force upon the crank. Hence both the power and velocity of the piton in the cylinder are to be considered as varying continually; and if the fly is sufficiently heavy, it will be found that the rotative motion is very nearly regular, while the ascent and descent of the piton are accelerated from nothing at the top of the cylinder, to its greatest velocity at the middle, or near the middle, and from that point it is retarded till it comes to nothing at the bottom of the motion. The table shews the exact increments and decrements.

It has been considered desirable to have such a motion, that the power and velocity communicated to the fly-wheel shall be at all times equable and constant. This was one of the first attempts to produce a rotatory motion, as we have mentioned, by Mr. Fitzgerald, at Hartley colliery, in 1768; it has been repeatedly attempted since that period. The most practicable form in which it has been tried was by Mr. Matthew Murray, who, in a patent dated 1799, for the improvement of steam-engines, describes a very ingenious movement for the purpose. The defect of all these contrivances for obtaining equal power on the rotative axis is, that the piton must act upon it all at once with a sudden shock, which is course of time destroys the best constructed mechanism.

In the Philosophical Journal is a description of a contrivance by Mr. Samuel Clegg, for producing a rotating motion from a reciprocating one, which not only simplifies the machine very much, but exceeds the power of the common crank one-third, in consequence of its acting being always perpendicular to the radius of the wheel, which is done by a vertical double rack and wheel. The two vertical ends of this rack are joined by a semicircle at the top, and both parts are toothed on the inside, so that the teeth of the vertical wheel are constantly in contact with some of the teeth of the fork formed by the two vertical bars and the semicircle uniting the double racks. The wheel and rack are constantly kept in gear by means of a small roller, a sliding-bar, and a plate, serving, instead of a groove, to keep the roller from deviation in this way. Although the change from the upward to the downward motion of the piton-rod will be great, the change from the downward to the upward motion must be instantaneous; or at least the piton-rod must be brought to rest at once, from an uniform motion downwards, and then receive instantaneously a finite velocity in the opposite direction.

A mode of giving a more uniform action to the crank, was attempted in an engine erected by Mr. Hornblower about 1795, at the brewery of Meux and Co., where the alternate power of two single cylinders was applied by chains acting upon circular arcs, at a constant distance from the centre of the lever; while the end of the lever which was connected to the crank; by the connecting rod continually varied in its action, and consequently in its force on the crank, nearly in an equal proportion to the alteration of the leverage of the crank. (See the sketch of this contrivance at fig. 7. Plate V.) The two cylinders A, B, of this engine made an alternate action on a band-wheel, D, by means of two chains. The lever which carried the connecting rod, F, was a wheel fixed on the same shaft with the band-wheel, and had a pin, E, near its periphery, to which the connecting rod, F, was attached. This pin traversed about one-fourth of the whole circle, and may be designated by the symbol 2 of the lever, which, in its action upward to 4, and downward to 2, ascended and receded to and from the centre of motion; and had it traversed through the remainder of the semicircle, it would then have pressed on the crank, G, proportionately to the sine of every angle it made in its revolution. But considering the great pressure on this pin in the crank-wheel, it would have demanded a degree of strength in that part which would have been preponderous, compared with the rest of the work.

This engine has its merits and its defects; it is subject to much more friction than a double-acting cylinder, by having two cylinders and their appendages; and unless the communication between the cylinders is clothed with the best materials for that purpose, a great loss of heat must ensue; because the surface exposed in two cylinders, compared with one double-acting cylinder, is as 2 to 1, and the friction of the pistons will be nearly in the same proportion.

The air-pumps in this engine (for it had two, though only one condenser) were worked by a small band-wheel, upon the same axis as the great band-wheel D; and from the opposite sides of this, the rods, 14, were moved by chains. The air-pumps were open at top, and the pressure of the atmosphere always refelt upon their pistons; but as the two were acting in opposite directions, they balanced each other as to power;
power: in this the inventor adopted the common double-barrelled air-pump of Haukbee, instead of the more perfect air-pump of Smeaton, which Mr. Watt employs. This engine was considered of 36 horse's power, and for many years performed all the work of the brewery. We have also seen some smaller engines built on the same plan, one of them with atmospheric cylinders.

It may be considered an advantage in this engine, that it has a double air-pump, whereas the double cylinder has only a single air-pump, which draws out the air from the condenser while the piston is making its ascending stroke; but during the descent of the piston the air-pump is inactive. We have seen many proposals for double-acting pumps.

Mr. Murray, in 1801, had a patent for a new air-pump, (see the specification in the Repository of Arts, fifth series, vol. xvi.); but we have not had an opportunity of ascertaining the performance of an engine so constructed; and as the ingenious inventor does not now adopt it in the steam-engines which he makes, we may presume it is not of great importance.

The proportion usually given to the air-pump of a double engine is about two-thirds the diameter of the cylinder, and half the stroke, or from one-fourth to one-fifth the capacity of the cylinder: the condenser is of the same size. Whether it is owing to the circumference of the single air-pump or not, we are unable to determine; but it appears that double-acting engines do not in general produce as great an effect from the fuel they consume as single engines of the same dimensions.

In Meflops' reports of the engines in Cornwall, generally contain the accounts of 20 or 25 engines, there are several enormous double engines for pumping the mines, with cylinders of 66 and 67 inches, and four of 63 inches. The belft of these appear to be on Williams' mine; cylinder 67 inches diameter, and working with a stroke of 8 feet 9 inches, under a pressure of 16.0 lbs. per square inch: it works 10 pumps, which are a load of 70,411 lbs., at the rate of 33 strokes per minute, of 6 feet 9 inches stroke; its performance with respect to coal was, in June 1816, 30,074.507 lbs. lifted one foot high for each bucket consumed. This is a very good performance; but all the other double engines are less, one of the 63-inch cylinders is 27 millions, the others 25, 22, 21, and even 17 millions.

The advantages are all on the side of the double engine; the diminution of surface which is exploited to condensation, the vis inertie of the parts in motion is much less, and the friction of the piston is very much reduced, although the friction of the pump or air-pump should affect the amount of power to be increased, because they must be bound tight, so as to have no shake or looseness; but this must be inconsiderable.

Before quitting the subject of double engines, employed to give a rotative motion to machinery by a crane, we must notice the remarkable difference, shown by Meflops' reports, between the performance of the small engines employed in drawing the matter out of the mines, and those in pumping water.

We should think the loss of power from friction in drawing up buckets by a rope, could not be greater than the friction of pump-buckets, and of the water moving in the pipes; therefore all the difference must be attributed to the application to the rotative motion, and to the smallness of the engines: these are usually 14, 16, and 24 inches in diameter, but their performance, with respect to coal, is only 3, 3 1/2, 4, and 5 millions. The best engine they have has only from 9 1/2 to 11 million pounds one foot high for each bucket of coal, which is only one-third of the produce of the best large engines employed in pumping.

One of Woolf's double engines at Wheal Fortune mine, in May, 1816, drew only three million pounds one foot high with each bucket; but another at Wheal Vor mine drew six millions.

Estimation of the Force of Steam-Engines in Horse's Power.

The method of estimating the mechanical power of any machine by the weight of water or other matter which it will raise to a given height, in a certain period of time, or with a given quantity of fuel, is the most unequivocal expression that can possibly be obtained; but as steam-engines are frequently substituted in the room of horses, it has been customary to calculate their mechanical energy in horse-power, or to find the number of horses which could perform the same work. This, indeed, is a very vague expression of power, on account of the different degrees of strength which different horses possess; but still, when we are told that a steam-engine is equal to sixteen horses, we have a more distinct conception of its power, than when we are informed that it is capable of raising a given number of pounds weight through a certain space in a certain time.

Prior to Mr. Watt's application of the steam-engine to produce rotative motion, the great manufactories of the kingdom had their mill-work put in motion by the agency of water, of wind, or of horses; and the latter had for many years been almost exclusively employed in the breweries and distilleries of the metropolis. It was, therefore, natural for those who wished to substitute the power of steam for that of horses, to state the number of those animals, to which the new power, under given conditions, ought to be equivalent; and it is probable that Meflops, Watt and Boulton felt, that such a mode of comparison would be more intelligible to common apprehensions, than a more accurate and scientific formula: it gave the power of an engine expressed in numbers, of which the ordinary strength of a horse is the unit. This, no doubt, is not in itself very exact, the unit being large, and subject to considerable variation. Relative to the purpose for which it was used, it was, however, sufficiently correct; and on this subject many similar occasions, a more minute measurement would have been less useful. But to give this unit all the accuracy which can be desired, they have assumed, from the result of experiments made with the strong horses employed by the brewers in London, that the standard of a horse's power is a force able to raise 33,000 lbs. one foot high in a minute: and this, no doubt, was meant to include an allowance of power sufficiently ample to cover the usual variations of the strength of horses, and of other circumstances that might affect the amount of power, according to the estimate just mentioned, we think the power of a horse is rated above the ordinary average, a circumstance which cannot be complained of by the public, as it tends to represent the advantage of the engines less than it will be found in real practice.

Dr. Brewster, in his edition of Ferguson, states that Meflops, Watt and Boulton suppose a horse capable of raising 33,000 lbs. avoiduplous one foot high in a minute; while Dr. Defaguillers makes it 27,500 lbs. and Mr. Smeaton only 22,916. If we divide, therefore, the number of pounds which any steam-engine can raise one foot high in a minute by these three numbers, each quotient will represent the number of horses to which the engine is equivalent, according to the estimate of these different engineers. We will take, for example, an engine having a double-acting cylinder, on Mr. Watt's plan, 24 inches diameter, and which makes 20 strokes per minute, each stroke being five feet long, and the force of steam being equal to a preasure of 10 lbs. per square inch. Required the number of horse-power of such an engine.

The square of the diameter of the cylinder being multiplied by the decimal number .7854, will give the area of the piston:
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piston; thus, 24 × 24 = 576 × 7854 = 4534 square
inches, which are exposed to the pressure of the steam.
Now, if we multiply this area by 30 lbs., the pressure upon
every square inch, we shall have 4524.4 × 10 = 4524 lbs.
the whole pressure upon the piston, or the weight which
the engine is capable of raising with a certain velocity. To
find this velocity, we say that the engine performs 20 double
strokes, each of five feet long, in a minute; the piston
must, therefore, move through 20 × 5 × 2 = 200 feet in
the same time; and, therefore, the power of the engine will
be represented by 4524 lbs. and 200 yards, raised through
200 feet in a minute, or by 94 1/2 hogheads of water, or
measured, raised through the same height in the same
time. Now this is equivalent to 4524 × 200 = 904,800 lbs. or
94 1/2 × 200 = 18,948 horseheads raised through the height
of one foot in a minute. This is reduced to the horse-power
of Mefire. Boulton and Watt, by dividing by 32,000, their
estimate of the horse-power: thus, 904800 ÷ 32000 = 28 1/2
horsepower.

According to Smeaton, 904800 ÷ 22916 = 394 horsepower.

According to Defaguglins, 904800 ÷ 27500 = 33
horsepower.

In this calculation, it is supposed that the engine works
only eight hours a day, so that if it worked during the
whole 24 hours, it would be equivalent to thrice the
number of horses found by the preceding rule.

Other Constructions of Mr. Watt's Double Engine.—A great
mass of matter must necessarily be put in rapid motion at
every stroke of the reciprocating engine, and the motion must be
flapped and returned at the end of the stroke. This is
an evident disadvantage under which the double engine
labors; so though all objections to the reciprocating, on
account of the irregularity of motion, is done away by
the application of a fly-wheel, the regularity thus attained
is at the expense of the power, as we have shown in the
practical results of the large engines for pumping, and
the engines for drawing from the mines. The most ob-
vious improvement in this particular, is to lighten the masts
of the great working beam, or to dispense with it alto-
gether. The enormous strain exerted on its arms requires a
proportional strength, and this requires a vast mass of matter,
not less indeed (in an engine with a cylinder of 32 inches
diameter) than three tons and a half; moving with a veloc-
ity of three feet in a second, which must be communicated
in about half a second, so that this mass must be brought
into motion from a state of rest, and must again be brought
to rest, again into motion, and again to rest, to complete
the period of a stroke. This consumes much power; and
engineers have not been able to load an engine with more
than 10 or 11 lbs. on the inch of the piston, and pre-
serve a sufficient quantity of motion, so as to make 12 or
15 seven-feet strokes in a minute. Many attempts have
been made to lessen this mass, by using a light fly-wheel,
or a light frame of carpentry, in place of a solid beam.

As an example of this is shewn in the beam of New-
comen's engine (Plate II.), a method which was intro-
duced by Mr. Smeaton; and another is shewn in Mr. Horn-
blower's (Plate V. fig. 1.) The form of this beam is such,
that it would be stronger than a solid beam containing a
great many times the quantity of timber, as there is scarcely
any part of it which is exposed to a transverse strain, but
every piece is either pulled or pushed in the direction of its
length. The only evident improvement of which it ad-
mits, is to apply a strong tie-bolt along the whole length
of the upper beam; because when tie-beams of wood are
used, it is very difficult to connect the iron flaps to the
ends of them in such a manner, that they will not become
loose in time. This is an objection to framed working
beams, for although they are abundantly strong at first,
yet, after being some time employed, the flaps and bolts
with which the wooden parts are connected, cut their way
into the wood, and the framings become loose in the joints,
and, without giving any warning, are liable to break to pieces
in an instant. A solid, massive beam of sufficient
strength bends, and feebly complains, (as the carpenters
experise it,) before it breaks. In all great engines, there-
fore, Mr. Watt at first employed such solid beams as were
found the most durable, and least likely to break in a long
course of work.

They were sometimes strengthened, in a very simple and
effective manner, by placing a king-post perpendicular to
the length of the beam, over its centre, and extending iron
tie-bolts from the top of the king-post to the two exter-
mities of the beam, so that the beam thus framed forms a
triangle, of which the beam is the base, the king-post the
perpendicular, and the iron ties the sides, meeting the per-
pendicular at the vertex of the triangle.

There was an expenient generally referred to, when the
beam was found to yield from a load, it could not stand.
There is, perhaps, no example, except the mast of a ship, in
which a piece of timber is exposed to such a severe strain as
the beam of an engine, because it is necessarily made as small as
possible; and it is relieved from the strain 15 or 20 times
every minute, so that all the fibres are tried to the utmost;
we accordingly see old beams, full of cracks lengthwise
from the fibres, separating laterally, and after this the beam
loses its strength.

Of late years, wooden beams have been altogether disused,
and iron beams substituted. We have already described
the mode of making the beam for the largest engines, by
two plates or slitsches put together parallel, and leaving a
space between them. For double engines, which are not
of the very large dimensions, it is usual to have the beam
cast in one piece, of a form best adapted to give the greatest
strength in the least weight. (See Plate IX. Steam-Engine,
Parallel Motions.) The extremities of the beam are turned in a
lathe to form cylindrical pins, and upon these pins are fit-
ted sockets or pieces, which have other pins projecting from them
to form the joints of the parallel motion and connecting rod;
so that when the sockets are fixed on the ends of the beam, the
pins will project from the beam in a direction perpendicular to
its length, and parallel to its axis of motion. There are two pins
thus projecting from each end of the beam, that is, one pin on
each side of the socket: the two links of the parallel motion
are fitted to the two projecting pins at one end, and the
double joint of the connecting rod is fitted on the two pins
at the other end of the beam. The advantage of this con-
struction is, that the joints at the ends of the beam become
universal joints, having liberty of motion in all directions;
but, in the direction in which the joints of the parallel
motion and connecting rod are to bend for the motion of the
beam, as shown in the figure, the motion will be
upon the projecting pins of the sockets; but if, from the axis
of the beam not being rightly placed, or from any other cause,
a lateral flexure is required in the motion of the beam, the
sockets of the joints will turn a little sideways upon the end
of the beam, and allow the deviation, without any strain on
the moving parts: were it not for this contrivance, the
smallest possible deviation from the perpendicular direction
of the cylinder would cause a great friction in the stuffing
box and joints. In Mr. Murray's best engines, the crank-
pin is also jointed to the connecting rod by a universal joint.

See Plate VIII. fig. 4.

All the joints of the parallel motion, the connecting rod,
O a

and
and crank, in short, all the moving joints of a double engine, must be fitted with brass sockets, which can be tightened round the pivots, so as to prevent all shake or looseness, which, in an engine that works both in ascending and descending, would be destructive of its action. The two great links of the parallel motion are each carried on a piece of a strap or loop of iron, bent so as to make a double link, in the upper bend of which are two brasses for the pivots at the end of the beam, and at the lower end are two others, for the pivots which project on each side from a socket, which is fixed on the top of the piton-rod. The brasses of the latter joint are held in by wedges, or cross-keys, put through the two links at the lower end, so that by driving the wedges farther, the brasses can be drawn tight at pleasure. The two inlaid brasses, that is, the lower brasses of the upper joint, and the upper brasses of the lower joint, are kept extended to their proper distance by a piece of wood, or a light frame of iron, fitted in between them.

But we have not yet satisfactorily explained the action of the parallel motion. It is plain that the piton-rod must ascend and descend in a perpendicular right line, and also that the end of the beam must ascend and descend in the arc of a circle. When the beam rises into the position of Plate VI. from a horizontal one, it gives the piton-rod a tendency to move from its perpendicular towards the centre of the beam, which must move towards it, was not the link, b, fastened to the beam and piton-rod by flexible joints; and while the lower end of the link, b, rises, the end of the bar or lever m, dotted, which is movable on a fixed centre m, also rises at the same time, and the angle between m and c increases, and likewise the angle between b and c increases slowly; so that the vertex of the angle between b and c would move towards B, if the bar, m, was not confined to move round the fixed point or centre m, while the other end rises along with the rod c. While m, therefore, rises upon its centre, the adjoining bar a, moves round the joint at its upper end, and draws c, and the lower end of b, from the centre of the beam, the angle between d and e increases, and the joint between d and c recedes from the centre of the beam; and as it cannot approach nearer to the joint between b and c, because of the rod c, it keeps a, and the bottom of b, in a perpendicular position; so that whatever tendency the joint between b and c has to approach towards the centre of the beam by the increase of the angle between b and c, is corrected by an equal tendency of the lever, m, to draw the angle between d and c in a contrary direction; but as the beam, B, falls into a horizontal position, in all these motions are reversed. In adjusting the parallel motion for work, when the piton-rod, a, is found to rub most upon the side of the collar of the stuffing-box nearest to m, the fixed centre point, m, must be shifted a little in the contrary direction, viz. to remove it nearer to the centre of the beam, and in an opposite direction if it is found to rub on the other side.

That the nature of this parallel joint may be better understood, it is proper to observe, that the bars which have been mentioned as made double, which cannot be shown in the figure, and that the two levers, m, m, are placed at a sufficient distance afdner to allow the links b, and the rods c, to descend between them.

Of late years, the framing for the support of the engine has been wholly made of cast-iron. A very good form is to make the cister, L, of cast-iron, all in one solid piece, and to fix the cylinder A upon it with four feet; a single column is then erected upon the end of the cister L, to support the centre of the beam: the fly-wheel is supported by small cast-iron standards rising from the ground; and the centre of the lever m, of the parallel motion, is supported by a small bracket or standard erected from the flange of the cylinder. By this arrangement, all the parts of the engine are so united, that they cannot deviate in the least from their position, unless the parts are actually broken. An engine of this plan is fully described in the British Encyclopaedia, vol. vi.

The engine represented in Plate VIII. fig. 4. is perhaps the most complete of all. It is of the form in which Meftra. Murray and Wood construct their engines, when they are not of a very large power.

Steam-Engines without Beams.—These have been made in a variety of forms. The simplest of all is to connect the piton-rod at once with the connecting rod, and to place the crank over the centre of the cylinder: the piton-rod must be guided by a parallel motion, or by sliders. The objection to this is, that the fly-wheel becomes elevated to too great a height for the communication of its motion, except in very particular circumstances, without shortening the connecting rod, which occasions the irregularity of the action of the crank to be greater than that of our table, in which the length of the connecting rod is supposed to be six times that of the crank, or three times the stroke of the engine, as a shorter cannot be made to work well. There is also a difficulty in balancing the weight of the piton-rod, connecting rod, and crank, and in giving motion to the air-pump. The balance-weight is usually placed on the rim of the fly-wheel; and the air-pump is either worked by a second smaller crank upon the axis of the fly-wheel, or by a short beam.

Engines of this kind are frequently placed with the cylinder horizontally, and for small engines this answer very well; but in large ones, the weight of the piton-acting always at one side bears the cylinder irregularly. Mr. Murray included this plan in his patent of 1799, which we have before mentioned, for producing the rotary motion without a crank; and he proposed to place rollers in the piton to bear it up.

Steam-engines with horizontal cylinders are used with the greatest advantage in steam-boats, as they can be made to lie low beneath the deck of the boat. Mr. Symington, we believe, first introduced this plan.

We have seen several engines working without a beam, in which the crank was placed immediately over the cylinder, and with the axis of the crank little more than its length above the top of the cylinder. For this purpose, the piton-rod is prolonged upwards to a length of three or four times the stroke of the engine, and the top is guided in a groove, or by a friction-wheel; near the upper end of it is jointed the connecting rod, which descends down to the crank-pin, situated behind the rod, and as close above the cylinder as it can turn round clear of its top. By this means, the ascent and descent of the piton-rod produce the rotation of the crank, the lateral deviation of the crank from the perpendicular being allowed for in the angle which the connecting rod makes with the prolonged piton-rod.

In this way the crank must be placed behind the piton-rod, or out of the line of it; but it is not then thought to work so well.

To remedy this the crank is made double, and the prolonged piton-rod has an opening in it for the crank-pin to pass through, and a connecting rod is placed on each side of the piton-rod, so that it is worked between the two. It is evident that the opening through the piton-rod must be a groove, equal in length to the stroke of the crank, so that the whole of the motion of the crank-pin, from one side to the other, can be admitted in the openings, without influencing
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influencing the piston-rod, except in its perpendicular ascent and descent.

The groove must be made wide, so that the pin cannot touch the sides of it. The pin is always retained in the middle of the groove by the connecting rods, of which there is one on each side, extending from the crank-pin to the top of the rod, which is prolonged in the line of the piston-rod, and is part of the frame forming the opening through which the piston passes. It is evident, that in this way the opening cannot be a straight line, but must be formed to a portion of a circle, of which the centre is the joint that unites the connecting rods with the rod which prolongs the piston-rod, and in a line with it.

Another plan for applying the connecting rod immediately to the piston-rod, without the intervention of a working beam, is to have the axis of the crank placed immediately beneath the cylinder bottom, and a crank formed on it at each side: a cross-bar is placed upon the top of the piston-rod, long enough to reach over beyond the flanges of the cylinder; and from each end of it a connecting rod is suspended, the lower ends of which are joined to the two cranks before-mentioned. This arrangement is, perhaps, the best of its kind, because the connecting rods are of a considerable length, without taking up any room.

Mr. Maudslay, of London, had a patent in 1807 for an engine of this kind, of which he has constructed a great number. Plate VIII. fig. 3, is a sketch of one of these.

The specification states the invention to consist in reducing the number of the parts of the common steam-engine, and in arranging and connecting them, as to render it more compact and portable, every part being fixed to, and supported by, a strong frame of cast-iron, perfectly detached from the building in which it stands: it is not, therefore, liable to be put out of order by the finking of the foundations. A is the cylinder, placed upon a frame of cast-iron plates B, B, which, at the same time that it elevates the cylinder to a sufficient height, forms the support for the axis of the fly-wheel D D. This axis has two cranks formed in it. E is one of the connecting rods, which, as before-mentioned, works upon the cranks up and down of the cross-bar, which is fixed at the top of the piston-rod, and which is guided in its ascent and descent by friction-wheels R, fitted upon it, and running in grooves N, N, formed in iron frames, which are placed in a perpendicular situation above the cylinder, and supported by a light iron framing O. Beneath the great frame, B, are placed two circular cisterns F, G, communicating by a pipe, which are for the condensing water: one has the cold-water pump in it, and the other contains the air-pump and condenser. These two pumps are worked alternately from the end of a short beam, H I, (fig. 3), placed beneath the cylinder, and put in motion by a small crank, or eccentric circle, which is formed on the axis of the cranks, in the middle between the two cranks, and acts in a groove or opening made in a projecting arm, \(X\), of the beam, a small parallel motion being applied to that end of the beam which works the air-pump. Instead of valves for supplying steam to the cylinder, a single cock, with four passages in it at L, performs the office of all the four valves: the lever of the cock is worked by a rod of communication from a handle, which is moved up and down every stroke by the rod of the air-pump.

The condenser is a hollow cylinder, and the air-pump is placed within it, so that there is no necessity for a pipe of communication from the air-pump to the condenser: a small cistern, \(r\), is fixed over the pump, to form the hot-well, and the discharge-valves of the pump are made in its lid or cover, and therefore in the bottom of the cistern.

A very ingenious method of converting the reciprocating motion of the piston-rod at once to a rotatory motion is represented in Plate IX. fig. 5. Parallel Motions. A toothed wheel, \(C\), of a diameter equal to half the stroke of the engine, is made to roll round within a ring or fixed wheel \(A\), having interior cogs, and being of a diameter equal to the whole stroke, or twice as great as the internal rolling-wheel \(C\), which is carried round in a circular orbit, so as to work in the cogs of the ring, by having the crank-pin, \(K\), for its centre of motion. By this means, every half turn of the crank will produce half a revolution of the centre of the small wheel in its orbit; and as it is all the time engaged by the cogs of the ring, it makes, during this motion, a whole revolution upon its own centre. The consequence of this is, that a point taken in the circumference of the small wheel, will travel up and down, across the centre of the interior ring, in every revolution of the small wheel in its orbit; that is, it will describe a right line, which is a diameter of the ring. A pin, \(P\), being placed in a proper position of the circumference of the small wheel, and the top of the piston-rod being attached to it as it ascends and descends, will produce a rotation of the crank, upon the axis of which the fly-wheel is fixed.

This parallel motion is described in the article Parallel Motion. It has been employed by Mr. Murray in many of his engines: the objection to it is, that the cogs in time grow loose, and it then makes a very noisy and unsteady motion.

Bell-Crank Engine.—This is a very compact form of the steam-engine, which Messrs. Boulton and Watt began to make soon after the expiration of their patent.

The cylinder is supported by brackets from the cast-iron condensing cistern, and is placed over one end of it. The beam is formed like a bell-crank, that is, a right-angled triangle, the centre of motion being at the right angle, and the axis of it is supported by bearings screwed to the cistern at the lower side; and at the end opposite to that upon which the cylinder is placed, the horizontal arm of the triangle forms the working arm of the beam, to the extremity of which the power of the cylinder is applied. At the upper end of the perpendicular arm the end of the connecting rod is jointed, and extends to the crank, which is supported in bearings screwed to the cistern at the same end at which the cylinder is placed, the centre of motion being at the same level with the top of the cylinder beneath the cylinder, the hypothesis of the triangle of the beam forms a brace to strengthen it. Two of these beams are used, and are applied on opposite sides of the cistern, upon the same axis of motion, and are united together by cross rods, so that they move together in the same manner as if they were one. There are, therefore, two connecting rods and two cranks; but they are formed upon one common axis of motion, which is prolonged, to carry the fly-wheel. To connect the piston-rod with the ends of the arms of the beam, or what we have called the base of the right-angled triangle, a rod is fixed upon the top of the piston-rod, across the fame, at right angles; and to the two ends of these two rods are links, which defend to the beam, and are jointed to it at the ends. By this means, the ascent and descent of the piston-rod produce a corresponding motion of the beam upon its centre of motion, and the upper end of the perpendicular arm moves backwards and forwards, and by means of the connecting rods turns the crank. The perpendicular arms of the beam are shorter than the arms to which the cylinder-rod is attached, so that the motion of the connecting rods, and the sweep
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Sweep of the cranks are less than in an engine where the arms of the beam are equal.

The rods which descend from the bar which is fixed across the top of the pinion-rods to the ends of the beams, are of such lengths, that the obliquity which is occasioned by the circular motion of the ends of the beams is small, and the engine does not require any parallel motion to keep the pinion-rods perpendicular. The fame of the air-pump, which is placed in the middle of the cistern, and is worked by two gears connected to the horizontal arms of the beams, at half the distance from the centre of motion at which the cylinder-rods are applied.

In these engines, valves are not used for admitting and taking away the steam from the cylinder; but to perform this office, a slider, invented by Mr. Murdoch, and represented in Plate VII., fig. 9, is used: the motion is communicated to the slider by an eccentric wheel or rim, fixed on the fly-wheel. The bell-crank engine is very compact, and is well adapted for temporary use, as it stands wholly upon the cistern, and requires no fixing. We have seen it used in a steam-boat.

Different Methods of admitting Steam alternately into the Top and Bottom of the Cylinder.—The arrangement of the four valves invented by Mr. Watt has been described. This is now almost universally laid aside, in favour of more simple contrivances, though we think there is not any method so complete in its action, or so durable. For large engines, four separate spindle-valves are still used; but the method of lifting them is changed, the spindles of one valve being formed like a tube, for the spindle of the other to pass through. This plan is described in the specification of Mr. Murray's patent of 1801, the same which was for the improved air-pump.

The arrangement of the pipes and passages is the same, and the valves are situated in the same places; but the boxes which contain them, instead of being square, are cylindrical, and the spindles of the valves are placed concentric with the axis of the cylindrical box. The spindles of the two steam-valves are perforated through the centre, in the manner of tubes, and rise through a flushing-box in the top of the box, and conveyers and the cylinders, and are lifted, instead of the lever or sector within the box, as described in the first engine. Through the tubular axis of the upper valves a small rod is conducted, which forms the spindles of the lower valves; and this junction is made tight by a flushing-box formed at the top of the tubes. The operation of the valves is in every respect the same as the former; the only difference is in the mode of communicating motion to them from the outside, and at the top of the steam-box, both pair of valves being moved by rods through an opening in the lid of the box. See Plate VII., figs. 4 and 5.

This method is neat in its appearance, and answers equally well with the other when properly made, but it is not easy to make it like the other; for if the lid of the steam-box, when fastened on, deviates in the smallest degree from the central position of the valve-spindle which passes through its flushing-box, both the valves will be prevented from applying themselves exactly to their seat. It is necessary for the two valve-feats, and the flushing-box through the lid, to be made precisely on a common centre, line, or axis; and for this purpose, the upper part of the cylindrical box which contains the valves is bored out correctly within, and the conical sockets in which the bell-metal feats for the valves are to be placed, are bored at the same time; then the lid of the box which has the flushing-box in it, being turned in the lathe, with a small projection beneath its flange to drop into the top of the cylindrical box, it will be certain to apply itself exactly in the centre of the box, and also perpendicular, when it is screwed fast down in its place, because the under surface of the lid, and the upper surface of the steam-box, have been accurately formed each of them concentric with, and perpendicular to, the axis of the valves; but it is necessary to use great caution in applying packing between these two surfaces, because it will yield unequally, if the screws at one side are screwed down more forcibly than those on the other side, and thus put the flushing-box out of the perpendicular.

To prevent this, Mr. Murray makes the lid of the box without any flange, but it is exactly fitted into a small reces or rebate, formed for it all round at the top of the steam-box, by enlarging the diameter thereof a small quantity, as shown in fig. 15. There is no packing applied to the joint, and it is then certain that the lid of the box will come to its true place. To prevent leakage, an iron ring is applied all round with a packing beneath it to cover the joint; and this packing and ring being screwed down by four screws makes the joint tight, and at the same time stops the lid from; but by relaxing the ring, the lid can be lifted out, and the valves with it, to repair them. Mr. Murray's patent was first by a writ of ceive facius, at the instance of Meffrs. Boulston and Watt, who had previously practised some things contained in the patent; but we believe Mr. Murray was the first who made valves in the manner represented in the figure.

In small engines, the machinery now employed for opening and shutting these four valves is different from Mr. Watt's original engine, and much more simple. The motion is given by a rotative motion from the main axis of the fly-wheel; a wheel is fixed on the axis of the fly-wheel, and communicates motion by other wheel-work to a horizontal axis (Plate VII., figs. 4 and 5), upon which are two eccentric wheels, which open and shut the valves alternately. Each of the boxes may be considered as being divided into three compartments by the two valves, and the steam is always admitted into the top of the upper box, where the upper steam-valve is situated; its use is to admit steam which comes from the boiler through the steam-pipe into the middle compartment of the box, which is the passage, 14, communicating with the top of the cylinder. In the same manner, the condensing-valve, which is moved by a rod passing through the rod or spindle of the upper steam-valve 12; the valve 8 is for opening a passage from the top of the cylinder to the condenser, through the exhausting-pipe 13. In the same manner, the upper valve, 1, of the lower box is called the lower steam-valve, and is for the purpose of admitting the steam which descends through the pipe, 12, into the bottom of the cylinder, below the piston. The valve 9 is for connecting the bottom of the cylinder with the condenser, and therefore called the lower condensing-valve.

The two rods, L, M, connect the four valves together in pairs; thus, the rod L has an arm projecting from it at each end, one at its top, fastened to the stem of the upper condensing-valve, and the lower steam-valve is connected with it at its bottom; it will consequently, when it is lifted up by the eccentric wheel, which is contained within an opening in the rod, open those two valves, and, by causing a vacuum above the piston, and a preasure of steam beneath it, will force it upwards to the top of the cylinder. The rod M is connected with the upper steam-valve at the top, and with the lower condensing-valve at the bottom. When it is lifted up by the eccentric wheel, which works in an opening in the rod, it admits steam above the piston, and causes a vacuum below, in which situation the piston will descend. One of the rods which connect the valves must be allowed to descend by its weight an instant before the other is lifted,
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Lifted, otherwise the steam will have a free passage from the boiler to the condenser; a fault which is called blowing through, but is an operation practised every time at setting the engine to work, after having been some time at rest, for the purpose of expelling the air from the condenser. To blow through with this engine, all the four valves must be opened at once, which is done by lifting up the two rods, L, M, both together.

Fig. 16 represents an ingenious form in which Mr. Murray makes the eccentric movements for working the valves, so that they will work all at once, and not have the liberty of returning until the proper time.

The eccentric triangle, A B, has its sides formed by arcs of circles: the axis of motion is made to coincide exactly with one of the angles, A, and the arc, B, is described from that centre. The eccentric triangle is included within a parallel groove, C D, in an iron frame, in which it exactly fits, as in the figure. In this position, it is evident that the frame is immovable; it cannot ascend, because the circular part, B, bears against the lower side, D, of the groove; nor can it descend, because the angle, A, bears against the middle of the upper side, C; at the same time, the eccentric leading can move round a certain part of a revolution before the rod will be moved at all, and then it will rise at once; so that the middle of the lower side of the groove, D, will bear against the angle or centre of motion, A, and the upper side, C, will be borne by the arc, B, of the eccentric triangle.

Four-passaged Cock.—Of late years, instead of the four valves invented by Mr. Watt, cocks and flaps have been much used for alternately admitting the steam into the cylinder above and below the piston; they have the advantages of simplicity and cheapness, as one cock or flider is made to answer the purpose of the four valves.

What is called the four-passaged cock is the most readily applied to practice. This is represented in Plate VII. fig. 6, which is the cylinder of an engine made by Mr. John Dickson, who erected a great number exactly the same; the cylinder and its piston, with the lid and stuffing-box for the rod, are evident from inspection. The cylinder has a flange or projecting ring round it, a little below the middle, by which it is held in a jacket or case of cast-iron c c e, which is constantly supplied with steam from the boiler by the pipe e: the pipe e is cut off at the top, and the steam is received at the bottom of the jacket. The steam in the jacket is conveyed into the cylinder by the pipe P, and thence into the passage k, which advances horizontally forwards, as represented by the dark circle b, fig. 6, and turns into the cock; the short pipe has a thin circular vane in it, turning upon a pivot to form the throttle-valve, as we have before described.

When the steam is not made to pass through the jacket, the circular passage, b, may be considered as the continuation of the steam-pipe coming immediately from the boiler; and then the throttle-valve is placed in SOME part of the same pipe; p p is the pipe conveying the steam away from the cylinder to the condenser, which is of the ordinary construction. K is a handle fixed upon a spindle, on which is a rack, turning a cog-wheel upon the end of the cock E; this rack is partly seen in the drawing, but the pinion is concealed. There are two pins fixed upon the rod of the air-pump, which take the handle K, as they move up and down, and thus turn the cock a portion of a turn each time; there is also a lever fixed upon the spindle of the handle K, the ends of which stop against the ends of a crooked steel-spring screwed to the iron frame supporting the bearings for the spindle of the rack; so that the motion allowed thereby to the handle, K, and the rack, will turn the cock one-fourth of a whole turn; but no more. N is a cock communicating (when open) from the jacket c e c to the pipe p p, and thereby to the condenser, for the purpose of blowing through at first starting the engine. Now, suppose the steam flowing through the steam-pipe, s, from the boiler, it enters between the jacket, c e c, and the cylinder, p a s, through the short pipe and throttle-valve into the opening b, thence through the crooked passage in the cock E, to the pipe j j, leading to the top of the cylinder, thus causing the piston to descend. The steam in the lower part of the cylinder escapes, by the pipe g, through the other passage of the cock E, and by the pipe p p, into the condenser. When the piston descends, the pump rod carries down the handle, K, which, with its rack a r, in the pinion on the end of the cock E, turns it into the position seen at fig. 7. The operation is now reversed, the steam enters from the jacket at b, through the cock E, and by the pipe g, into the bottom of the cylinder, forcing the piston to the top; at the same time the steam contained above the piston escapes through the opening j j, and the cock E, by the pipe p p, into the condenser. When the pin on the air-pump rod reaches the handle, K, in its ascent, it returns the cock to the position at fig. 6, when the operation is repeated.

Nothing can be more simple, or appear more perfect, than this contrivance, which was originally used by Papin in his air-cylinders; and Leopold, in his Theatrum Machinarum Hydraulicae, vol. ii. has shewn the manner of its application to a high-pressire steam-engine.

In practice it has several objections. The pipe leading from the top and bottom of the cylinder to the cock is so much added to the volume of the cylinder, and the quantity of steam which they contain must be weighed every stroke without any advantage; but in the four valves, there is no further loss than of the small quantity of steam which is contained in the passages 14 and 15, Plate VII. fig. 1, which are purposely made as narrow as they can be to admit the steam freely. Secondly: The passages cannot conveniently be made large enough to admit a full supply of steam, though it should be understood, that, in the other direction, they are three or four times as wide as they appear in the section, fig. 6.

In these engines the steam is always wire-drawn in passing through the passages; hence the steam in the boiler must be made stronger than it is intended to be used in the cylinder, to which, however, there is no objection, as it gives it something of the expansive action. Thirdly: These cocks do not wear equally, because there is much less surface exposed to friction in the part where the passages are; and as the surface which is interposed between the passages is so small, they leak immoderately from one passage to the other, unless the fitting of the cock is perfect. For these reasons, the four-passaged cocks have been confined to small engines, and principally those which work with high-pressire steam, because that will pass through very small openings.

Mr. Bramah has made several steam-engines, in which he employed a four-passaged cock on a construction somewhat different from the above. The steam from the boiler is made to enter into a hollow at the large end of the cone,
of the cock, and to pass away to the condenser by a passage at the small end of the cone of the cock, which, by this means, is always prefixed into its seat by the force of the steam acting upon a surface equal to the small end of the cock, from which the pressure is relieved. This keeps the cock always tight; and to prevent the moveable part from being fixed fast by the pressure, the cone is made much more obtuse than usual. The passages for the steam between the cock, and the top and bottom of the cylinder, are nearly the same as in fig. 6. Mr. Bramah had a patent for this in 1802; and another improvement was, that he made the cock to turn continually the same way round one-fourth at a time; by which means the same effects are produced as by turning it backwards and forwards, but the wear is rendered more equal.

Mr. Maudslay has adopted in his engines a four-paffaged cock, in which the steam is made to pass the cone into its seat.

**Sliding-Valves by Mr. Murray.** With a view of remedying the inconveniences of the four-paffaged cock, the same effect has been attained by a plate sliding upon a flat surface, in which the passages are formed. A cylinder, with a slider upon this construction, is represented in Plate VII. fig. 8. It is used by Mr. Murray in small steam-engines, and found to answer the purpose extremely well, from the simplicity of its construction, and its durability, but, above all, from not being subject to wear or get out of order. A, B represent the cylinder, inclosed in a cast-iron jacket, and surrounded with steam; it is furnished with a piston, and a stuffing-box, for the rod to pass through in the usual manner; C is the passage for the steam to enter the top of the cylinder; and D is the passage into the bottom, to admit steam below the piston. The steam is conveyed by the boiler by the pipe B, passes through the throttle-valve C, and into the steam-box D, from which it is distributed to the cylinder by its different passages, as required. This steam-box is screwed by a flange against the flat surface of a pipe D, extending from the top of the cylinder to the bottom, and attached by dove-tailed joints to the two necks, A, B, of the cylinder. In the flat surface of the pipe D, there are three openings, ma, n, o: the upper one, m, communicates with the top of the cylinder; the middle one, n, communicates with the condenser by passing out sideways to the eduction-pipe, as at the dark circle at p; and the lower opening, o, communicates with the bottom of the cylinder by the passage b: r is the slider, made in the form of a box or cover, and ground round its edges, so as to fit exactly flat against the surface of the steam-pipe D, in which the three openings are made, and which is ground also. This pipe is moved up and down by the small sector s, acting in the teeth of a rack, fixed to the back of the slide. The spindle of the sector passes through a stuffing-box in the side of the steam-box, and is moved on the outside by an eccentric wheel on the axis of the fly-wheel. The motion of the slider, r, up and down, either connects the openings of the two passages m and n, or the two openings n and o. In the drawing, it is represented as connecting the upper passage m with n, which leads to the condenser, at the same time leaving the opening o uncovered; to receive the steam from the steam-box; and consequently the steam enters below the piston, through the neck a, causing it to rise, and escapes from the top of the cylinder through the neck a1, and by the connection of the opening m with n, it passes out at p into the condenser. Now if the slide is moved down, by turning the sector s, so that the lower passage o is connected with s, which leads to the condenser, the top opening m will be open to the steam-box, and the steam will enter at the top of the cylinder, and cause the piston to descend, while the steam in the bottom of the cylinder will rush through the opening b, and by the connection of the passage o with n, it will pass into the condenser. In this manner, by alternately moving the slide up and down, this action is repeated, and the engine kept going.

In the figure of Mr. Murray's small engine (Plate VIII. fig. 4.) the eccentric circle B is plainly seen upon the axis of the fly-wheel; it operates exactly the same as a short crank, and has an iron frame or collar embrace it. By this a motion backwards and forwards is communicated by the rod B S to an axis, upon which are levers, giving motion to the lever of the sector, which moves the sliding-valve. The whole of the engine is upon an excellent construction: the air-pump is worked by the rod R, at the outer end of the beam.

In 1799, Mr. William Murdoch of Redruth, in Cornwall, obtained a patent for several improvements in steam-engines, amongst which is a simple construction of the steam-valve, or contrivance by which the steam is distributed to the cylinder, or withdrawn from it at the proper period.

This contrivance is a sliding-valve, which performs all the offices of the four-valves which we have described for the double engine. Mr. Murdoch's patent has been adopted by Melliss. Watt and Boulton in most of their small engines, for many years past; and they have lately, with some alterations, introduced it into large engines. In Plate VII. fig. 9. A is the steam-cylinder of the engine; B, the piston, and C, the piston-rod; D is the upper opening of the steam-way into the cylinder; F is the steam-cake; in this is applied the sliding-valve, which performs the office of all the four steam-valves in the manner following. G G is a semicylindrical steam-pipe, (but which may be cylindrical, triangular, or of any convenient form,) communicating with the steam-cylinder both at its upper and lower openings, and firmly fixed or connected to the steam-cake, or with the cylinder itself, where no steam-cake is used.

This tube has an opening, H, on its side, with a regulating valve for the admission of steam from the boiler; and an opening, I, at bottom, which leads to the condenser. At the top it is covered with a plate T, having a hole and stuffing-box to admit the sliding-rod K, which is jointed to, or connected with, an inner moveable pipe or tube L M, open at both ends. To one side of the sliding-tube are affixed the solid plates or valves L, M, intended to slide upon the plates at D and E, and occasionally to cover and uncover the upper and lower openings D and E of the cylinder. Opposite to these plates the remaining circumference of the tube, L M, is furnished with projections or flanges of brass, or other metal, with an interface between them, to receive a packing of hemp, or other proper substance, which will permit the tube, L M, to move up and down, steam-tight, in the fixed tube G G. There are openings provided in the steam-pipe G G, which are shut with plugs or plates, screwed or otherwise fixed to it, which may be removed to repair the packing.

When the sliding-tube, L M, is in the position shown in the figure, the steam enters through the steam-pipe HI, and fills the interstices between the steam-tube G G, and the sliding-tube L M, passes into the cylinder at the upper opening D. As the lower opening, E, is open to the condenser, a vacuum will be formed within the sliding-tube L M, and also below the piston, through the passage E, which is uncovered by the rise of the sliding-rod. In consequence, the piston descends; and when it has got near the bottom of
of the cylinder, a bracket, attached to the top of the piston-rod C, strikes a projection upon the sliding-rod K, and causes the tube, L M, to defend a small quantity in the steam-pipe G. The sliding parts, L, M, by this motion, slide past the openings D and E of the cylinder, so as to be beneath them; and the steam, which is above the piston, issues at the upper opening, and pales down the inside of the tube L M, into the condenser. At the same time, the steam passing from past D E, through the pipe H, and the interface between the steam-pipe and the sliding-pipe, enters the cylinder by the lower opening E, and forces up the piston and piston-rod, with its bracket, which, near the end of the ascending stroke, encounters another projection of the sliding-rod K, and raises the tube, L M, into its former position of the figure. The operations are then repeated. This is the plan used in Melfra. Watt and Boulton's bell-crank engine, and it is very good, because no steam is lost, as in all other constructions, where only one cock or slider is used.

If the sliding-plates, where they apply together, are made of steel, and hardened, they then wear extremely well. In some of Melfra. Watt and Boulton's latest engines, they have used similar sliders for large engines; but, in this case, they make the two sliders separate, being moved only by a rod of communication; because, if they were applied to a strong moving pipe, there would not be so great a certainty of their complete action, as the least deviation of the two sliders at the top and bottom of the cylinder would cause a great leakage.

There are many other methods of distributing the steam alternately to the top and bottom of the cylinder; but as we have described those which are brought to such a degree of perfection as to be commonly used, it is unnecessary to pursue the subject any farther.

Regulation of the Velocity of an Engine.—This is a matter of considerable importance. The most common method, as we have noticed, is by the governor or revolving pendulum; but there are others which, in particular circumstances, are very applicable. One is to have a small pump worked by the engine, and raising up water into a cistern, from which it runs out again in a constant stream. By this means, the water will accumulate and rise in the cistern, if the engine works rapidly, so as to pump more water into the cistern than will flow out of it in the same time; and, on the other hand, the surface of the water will fall in the cistern, if the engine works slowly; and a float being placed in the cistern, and connected with a wire to the throttle-valve, will regulate the motion of the engine. See Regulator.

In 1805, Mr. Job Rider obtained a patent for improvements in the steam-engine. These improvements consist, first, in lining the steam-cylinder with a soft metal, of a sufficient thickness to admit of finishing the inside of the cylinder of such metal, by drawing, boring, or otherwise; secondly, in applying a hollow piston-rod, anwering the purpose of an eduction-pipe; thirdly, in the order of opening and shutting the valves; and fourthly, in regulating the speed of the engine by a pendulum. The nature of this latter contrivance is very ingenious, and may perhaps be understood from the following description. Upon an horizontal arbor, which we will denominate the main arbor, are placed three wheels, a drum or barrel, and a pinion; one of these wheels, that is to say, the main wheel, is fitted by means of a socket upon the main arbor, so as to turn round upon that arbor, and has teeth both upon the exterior and interior periphery of its rim. Within the circle of the interior egs of this wheel a pinion is fixed to the arbor, its diameter being one-third of the interior diameter of the main wheel; and this pinion has teeth surrounding its convex surface. The moveable barrel turns freely upon the main arbor; its diameter is rather less than the exterior diameter of the main wheel, and it carries a cord, with a weight hanging at its end, acting like a clock-weight. Besides this, the ends of the barrel are pierced with two orifices, each at about half the exterior radius of the main wheel from the arbor; these holes serving as bulges or pivot-holes, wherein an arbor turns, carrying a wheel, of which the diameter and number of teeth are equal to those of the pinion; the latter wheel may be called the barrel-pinion; its teeth work in the teeth of the pinion, and also in the interior teeth of the main wheel. By these means, the barrel may be turned round upon the main arbor, while the arbor itself is turned by the pinion, which is asked upon by the barrel-pinion, at the same time that this pinion acts upon the interior teeth of the main wheel. The external teeth of the main wheel turn the pinion of a crescent-wheel and pallets, nearly similar to those in Graham's dead-beat. Near one end of the main arbor there is a ratchet-wheel, and wheel and click; and near the other end a wheel, which is asked upon by an endless screw upon a horizontal shaft, worked by the general operation of the steam-engine.

This arrangement serves to regulate the rate of the engine's motion; for the turning of the worm-wheel, by the general motion of the engine, causes the weight to be raised which hangs to the cord that winds upon the barrel; and this weight is connected to one end of a lever, the other end of which is attached to the cistern in such a manner, that the degree of opening of that valve depends upon the altitude to which the weight is raised. The aperture of this valve is formed like an inverted cone; and while this valve shuts and opens twice at every stroke, the lever does not prevent such opening and shutting, but merely limits the extent of the opening by the springing up of a rod connected with it. By this contrivance it happens, that when the weight is highest, the valve is least open; and when the weight is lowest, the valve is most open. Hence it is evident, that should the engine wind up the weight, by turning the worm faster than the pendulum permits it to defend by the turning of the barrel, the aperture of the valve will be contracted; and vice versa. Little power is lost by these means, and the speed of the engine can be accurately regulated by properly adjusting the length of the pendulum, and the numbers of teeth in the wheels and pinions. As to the ratchet-wheel and click, their sole use is to prevent the weight from drawing the line off the barrel, when the worm-wheel is thrown out of gear. We have not had an opportunity of seeing one of these machines at work, but think it would operate very well.

Mr. Cartwright's Engine.—In giving the history of Mr. Watt's inventions, we mentioned that the condensation by external cold was one of his first ideas, and given up, because he found it better to employ injection. We have also described his single engine, in which the piston rises to vacuo. In 1797, Mr. Cartwright took out a patent for improvements in the construction of steam-engines, in which the condensation is performed by the application of cold to the external surface of the vessel containing the steam.

The manner Mr. Cartwright effects this is by admitting the steam between two metal cylinders, lying one within the other, and having cold water flowing through the inner one, and surrounding the outer one. By these means, a very thin body of steam is exposed to the greatest possible surface of cold metal. By means of a valve in the piston, there is a constant communication at all times between the condenser and the cylinder, either above or below the pisto...
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ton; so that whether it ascends or descends, the condensation is always taking place, in the same manner as Mr. Watt's engines, where the piston rides in vacuo. But what was probably esteemed one of the most important circumstances attending the mode of condensation, was the opportunity it afforded of subduing ardent spirit, either wholly or in part, in the place of water, for working the engine. For as the fluid, with which it is worked, is made to circulate through the engine without mixture or diminution, the using alcohol, after the first supply, would be attended with no very great expense; on the contrary, the advantage was expected to be great, even equal to the saving of half the fuel. If, indeed, the engine could be applied, as Mr. Cartwright occasionally purposed, both as a mechanical power and as a still at the same time, the whole fuel would be saved.

Mr. Cartwright has been very attentive in simplifying all the other parts of the engine, his engine having only two valves, and those as nearly self-acting as may be; in consequence, the engine is rendered applicable to purposes requiring only a small power, and for which any other engine would be too complicated and expensive. See a figure of Mr. Cartwright's engine, Plate V., fig. 8, where $a$ is the cylinder, which is supplied with steam from the boiler through the pipe $b$; $c$ is the piston in the act of going up; $d$ is the attention-the pipe constructed within the condenser $e$, which consists of two cylinders, one within the other, leaving a small space between them, into which the steam is admitted; while the inner cylinder is filled with cold water, and also the external cylinder surrounded by the same; so that, by this means, a very large surface of steam is exposed to the cold of the water, though no water is suffered to come in actual contact with it.

To the bottom of the piston $c$ is attached a rod, with another piston $f$, working in the barrel $d$, which is in reality the air-pump of the engine, and has a pipe, $f$, to the condenser. When the piston $c$ arrives at the bottom of the cylinder, a valve, $r$, which is in the piston is opened, by its tail prefling against the bottom of the cylinder, which opens the communication from above the piston to the condenser, while the spring $k$, fixed to the rod of the piston, preffes down the tail, and shuts the steam-valve $s$, which admits the steam from the boiler. The steam therefore within the cylinder, both above and below the piston, being condensed, runs through the lower pipe, $f$, to the air-pump, and the piston, being relieved from all preflure, is drawn up in the cylinder by the fly-wheel. The piston of the air-pump arriving at the top of the barrel, in which it works at the same time with the working piston $c$, draws the air from the condenser, and on its return at the next stroke, prefles upon the condensed water, shuts the valve $f$, and forces the water up the pipe $g$, into the box $h$; the air which is difengaged from the water rides to the top of the box, and by its elastic forces forces the water through the pipe $i$, which carries it back again to the boiler. When the air accumulates in the box to such a degree as to depress the water, the ball-cock falls with it, and empties the valve of the top of the box, which fufers some of the air to escape.

When the piston arrives at the top of the cylinder, it prefles up the steam-valve $s$, which admits the steam again from the boiler, to force it down as before; and the valve, $r$, in the piston shuts by prefling up beneath the top of the cylinder. The preffure of the steam is now above the piston, and a vacuum beneath; the piston therefore descends, and when at the bottom, shuts the steam-valve $s$, and opens the valve, $r$, in the piston.

When all the steam in the upper part of the cylinder is condensed, the motion of the fly attached to the machine brings the piston up again, its valves now remaining shut by their weight.

If and $m$ are two cranks, upon whose axes are two equal cog-wheels working in each other, for the purpose of converting the perpendicular motion of the pinion-rods into a rotary motion for working the machinery attached to it.

As it is evident, from its construction, that the whole of the steam is brought back again into the boiler, it affords the means of employing ardent spirit instead of water, and thus having a great deal of fuel.

Cartwright's Metallic Piston.—The most valuable part of this engine is in the construction of the piston, which Mr. C. made wholly of metal, so as by means of springs to fit the cylinder very exactly.

This not only saves the expense and trouble of packing, which must be frequently renewed in all other engines, but also a great deal of steam, on account of the more accurate fitting of the piston. This piston is made in the following manner: Two metal rings are ground, by means well known to good mechanics, into the cylinder, so as to fit it as perfectly as art and industry can make them; that is so well, that no steam can pass between them and the cylinder; their upper and under sides are also ground perfectly flat, and applied one upon the other. Though the absolutely necessary, for greater security two other rings are fitted to the inside of these. On the upper rings is placed a plate of metal, also ground perfectly flat, and of such a diameter as almost to fit the cylinder. A similar flat plate is placed below the under ring; and the two plates, with the rings between, are attached firmly to each other by means of the pinion-rods that pass through them, and they thus form a shell, in which the other rings are contained.

It is plain then, supposing neither the outside rings nor the cylinder are able to wear one another, that such a piston would remain steam-tight; but as constant friction must inevitably tend to enlarge the cylinder, and diminish the diameter of the rings, the piston, after some time, would cease to fit, if a contrivance had not been made to remedy the evil. The rings are each of them cut into three pieces, and in cutting them, such a portion of the metal is taken away as to leave room to introduce, between two of the pieces, a spring in form of the letter V, the open end of which is placed outwards, almost close to the circumference; by which means the two pieces against which the two fides of the spring act are prefled, in the direction of the circumference, against the ends of the third piece; so that the three pieces are kept so uniformly in contact with the cylinder, that the longer the machine is worked the better the rings muft fit.

To prevent steam passing through the cuts in the rings, the solid parts of the upper rings are made to fall upon the divisions and springs of the under ones, so as to form a break joint.

The stuffing-box round the pinion-rod was proposed to be done in the same manner.

The metallic piston has been found advantageous, and Mr. Wolfe uses it in his engine, which is the greatest trial of a piston, because of the rarity of the steam. Plate VII., figs. 10 and 11, represent a piston of a four-horse engine, which was made by Meffrs. Lloyd and Ofcel. A is the pinion-rod, and BCC the solid metal of the piston, firmly fitted and keyed to it; the lower edge, C, of the plate, B, is made very nearly to fit to the cylinder; but for the actual fitting, dependence is placed on the four rings, D, fitted one upon another, and each divided into four segments, as shown by fig. 10. The interior surface of these rings is made rather conical, and a second set of smaller rings, $E$, is accurately fitted.
fitted withinside of them. These rings are divided, like the former, each into four segments, and the springs are applied behind them, as shown in fig. 10, in a better manner than the original, which were like the letter V. E E is the cover-plate, which is screwed over all the segments, to confine them; it prevents down the interior rings into the exterior, and the contact between them being by a conical surface, the effect is to spread the outer rings small quantity, and enlarge them till they exactly fill the cylinder. The dark mark beneath the lowermost interior ring E, is a piece of felt or pasteboard, which sustains the rings, and prevents them from descending, except when the screws are tightened, or the rings would expand with too much force into the cylinder.

**Woolf's Improvised Piston.**—The common method of packing the piston of a steam-engine with hemp, will be so well understood after what we have said, that a particular description of it in this place is not necessary; suffice it to say, that the hollow part round the piston is filled with rounds of hemp, loosely twined into a soft rope, which is pressed into a pretty compact form by a ring, and worked down by screws distributed round the ring, which work into the body of the piston; by this means the packing is made to fill the diameter of the cylinder pretty closely, and to prevent, while the packing remains found, any steam from palling between the piston and the cylinder. In the usual method, whenever the piston, by continued working, becomes too easy, and so occasions a waste of steam, it is necessary to remove the top of the cylinder, even when rent hemp or packing is not wanted, merely to get at the screws, which serve to force the upper ring nearer to the bottom of the piston, by which means the packing is forced outwards against the side of the cylinder.

This being heavy laborious work, it is generally deferred, by the man that attends the engine, as long as the engine can possibly be made to work without taking this trouble; and in consequence of this neglect, a great and unnecessary waste of steam is occasioned, and a waste of fuel in proportion.

Mr. Woolf's improvement on the piston is such as to enable the engine-man to tighten the piston, without the necessity of taking off the cover of the cylinder, except when new packing becomes necessary. He accomplishes this by either of the two following methods. He fastens on the head of each of the screws a small cog-wheel, c, c, c, (Plate VII. figs. 12 and 13.) which wheels are all connected with each other by means of a central wheel d d, which works loose upon the piston-rod in such a manner, that if any one of the small wheels and its screw be turned, it turns the central wheel, and the latter turns all the other three wheels and screws. That one which is to be first turned is furnished with a projecting square head e, which rises up into a recess in the cover of the cylinder. This recess is surmounted by a cap or bonnet, which being easily taken off, and as easily put again in its place, there is little difficulty in screwing down the packing at any time, by applying a key to the square head of this screw. The parts are so clearly expressed in the plates, that no further description is necessary to make any person comprehend it.

Mr. Woolf contrived another method for small pistons, which is familiar in principle, but a little different in construction. Instead of having several screws, all worked down by one motion, there is in this but one screw, and that one is cut upon the piston-rod itself; on this is placed a wheel of a convenient diameter, the centre of which is furnished with a female-screw. This wheel is turned round, i.e., screwed down by means of a pinion, which is furnished with a square projecting head, rising into a recess of the kind already described. The upper ring of the piston is prevented from turning with the wheel by means of two fixed pins.

**High-Pressure Steam-Engine.**—The operation of the high-pressure steam-engine is effected solely by the expansive force of steam, which is not condensed in the manner of the atmospheric or Watt's engine. The steam being raised in the boiler, and heated far beyond the boiling point, is made to acquire a great expansive force before it is allowed to escape from any vessel in which it is confined, even as great as four or five times the pressure of the atmosphere. This steam being allowed to enter into one end of a cylinder, while the other end of the same communicates with the open air, it will exert a force upon the piston of the cylinder, and move it from one end to the other. This is the principle of the high-pressure engine, which has been much introduced of late, on account of some advantages which it possesses in particular situations over other engines: first, from the simplicity of its construction and cheapness; secondly, the small space which it occupies; thirdly, it requires no condensing water, which in some situations is very difficult to procure, and in one instance is altogether impracticable, viz., for drawing of carriages, for which purpose this engine has been successfully used. To get against these advantages, the high-pressure engines are extremely liable to blow up, if not attended very carefully, for they are frequently worked with a pre-pressure of from thirty to eighty pounds on the square inch. These engines require a greater quantity of coal, in proportion to the force exerted, than the engines of Mr. Watt, and consequently are not worked with advantage in a situation where coals are dear.

The first application of high-pressure steam to an engine, is what we find described in 1724, by Leupold, in his Theatrum Machinarum Hydraulicorum, vol. ii. p. 93. He describes the invention to Papin, on account of his having given him the idea of applying the expansive force of steam for the purpose of raising water, and also because he took the construction of the four-paffaged cock, to communicate alternately with two cylinders, from Papin's air-machine, which had been described in the former part of this article. The engine described by Leupold consists of two single cylinders, placed at some distance from each other, with a piston fitted to each, and applied to two separate beams, which at the opposite ends work two forcing-pumps. Between the two cylinders is the four-paffaged cock, the same as described in Plate VII. Steam-Engine, fig. 6, for admitting the steam from the boiler alternately into the bottom of each cylinder, or allowing it to escape from the cylinders into the air. The boiler is situated beneath the two cylinders, and communicates with the cock by a short upright pipe. The action of this engine is very simple: the steam being raised very strongly in the boiler, is allowed to enter through the cock into the bottom of one of the cylinders, at the same time that the air or steam escapes from the bottom of the other, through the other passage of the cock into the open air. In this way, the pre-pressure of the steam causes the aforesaid of the first-mentioned piston, and the other descends by its counter-weight. By turning the cock round one-fourth, the operation is reversed, so that the steam enters the bottom of the second cylinder, and the steam which was contained in the first escapes through the passage of the cock into the air.

The next proposal for a high-pressure engine is Mr. Watt's patent of 1769. See the fourth particular of his specification, which we have given, but we do not know that he ever practised it, finding his own invention so much superior.

The high-pressure engines at present in use were introduced by Mr. Trevethick, in conjunction with Mr. Vivian, who obtained a patent for the same in 1803: this was particularly
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...ally for their application of the engine to the purpose of driving of carriages upon rail-roads.

This engine containing no material parts which are not used in other engines, and before described, it may be explained without a drawing. The boiler consists of a large cylinder of cast iron, made very strong, and placed upon its horizontal axis upon short feet or pillars, so that the boiler has a flange at one of its ends, to screw on the end or cover, which has the requisite openings for the fire-door, the man-hole, the exit for the smoke, and the gauge-cocks. The fire is contained within the boiler, in a cylindrical tube of wrought iron, which is surrounded with water on all sides, in the same manner as the fire in Mr. Smeaton's portable engines, of which we have given the description; but there is a little difference in the application: one end of this tube is flanged to the end or cover of the boiler, and is divided into two parts, by having the fire-grate extended across it: the fire-door closes the opening in the upper half, which is the fire-place, the lower half forming the ash-pit: the tube extends nearly to the end of the boiler, where it is reduced in size, then doubles, and returns back in a direction parallel to the first tube or fire-place to form the flue or chimney, till it arrives at the end or cover of the boiler, through which it pusses at the side of the fire-door, and a flue is then conducted from it into the chimney, to carry off the smoke.

At the part where the flue enters the chimney is a small door, to pass through any fuel that may have accumulated there. On the top of the boiler is a safety-valve, kept down by a lever and weight, to allow the steam to escape if it becomes so strong as to endanger the burning of the boiler. The steam-cylinder stands in a perpendicular direction, and is inclosed within the boiler, except a few inches of its upper end, at which the four-passaged cock is situated, and the flange which screws on the lid, with the stuffing box for the piston-rod to pass through. The boiler has a projecting neck, into which the cylinder is received, and it is fastened in its place by a flange round the upper end of the neck of the boiler, which is united by screws to a flange projecting from the cylinder at about one-third from its top flange. The upper end of the piston-rod is fastened to the middle of a cross-bar, which is placed in a direction at right angles to the length of the boiler, and guided in its ascending and descending vertical motion, by sliding upon two perpendicular iron rods, fixed to the boiler, parallel to each other, being connected together at top, and firmly supported there by two diagonal slats, extending from the other end of the boiler, and secured to the flange, which screws on the end of the boiler. At the ends of the cross-bar of the piston-rod the two connecting rods are jointed, and the lower ends of them are connected with two cranks, fixed upon an axis, extending across beneath the boiler, and under the centre of the cylinder: the axis is supported in bearings made in the legs which support the boiler, and the fly-wheel is fixed in it. One of the cranks is formed by a pin which is fixed into the arm of the fly-wheel, at the same radius as the opposite crank. The fly-wheel is situated close to the side of the boiler, and the pin for the other crank is fixed into the arm of a large cog-wheel, fixed on the axis of the fly-wheel, at the opposite side of the boiler. This cog-wheel communicates the power of the engine to other cog-wheels. As the piston is alternately forced up and down by the pressure of the steam, it carries the cross-bar with it, and by the connecting rod turns the two cranks, together with the fly-wheel and cog-wheel.

It now remains to shew the means by which the steam is brought to act alternately on different sides of the piston. On one side of the cylinder, just above the flange which fixes it into the boiler, and beneath the top flange, which fastens down its lid, is a protuberance of cast iron, to contain the four passages and the cock, similar to that shewn in fig. 6 and 7. One passage rises directly from the boiler, and brings steam to the cock at one side, to be distributed either to the top or bottom of the cylinder, according to the position in which the cock stands. A second passage is at both ends of the upper side of the cock, and proceeds to the top of the cylinder, for admitting steam above the piston. The third passage from the under side of the cock connects with the bottom of the cylinder by a pipe cast close to the side thereof, and descending to the bottom. The fourth passage from the cock is on the opposite side to where the steam enters from the boiler, and this passage is open to the waite-pipe, which carries the steam into the external air, and allows it to escape after it has passed through the engine. Now suppose the passage leading to the top of the cylinder, and that one which brings steam, from the bottom of the cock to be connected with the cock, and the passage from the bottom of the cylinder to be connected with the waite-pipe, the steam will enter above the piston, and force it down, at the same time that the steam in the bottom of the cylinder will escape by the connection of the waite-pipe with the open air.

When the piston arrives at the bottom of the stroke, the cock is turned one quarter round, by means of a rod jointed to the cross-bar of the piston-rod, and descending perpendicularly, being guided by pieces of iron screwed to the flange of the cylinder: this rod has two pins projecting from it, which move the handle of the cock up and down alternately; by this the cock is turned on the completion of the descending stroke, so that the passage to the bottom of the cylinder is connected with the boiler, and that from the top with the open air: the steam in consequence enters below the piston, and forces it up, passing out from the upper part of the cylinder into the open air at the same time. In this manner the motion of the engine is kept up by the pins alternately turning the cock, first at the top of the stroke, and then at the bottom.

The boiler is supplied with water, as fast as it evaporates, by means of a small force-pump worked by the engine; but as it would be a great loss of heat to inject cold water at once into the boiler, it is first rendered nearly or quite boiling by a very simple contrivance. The waite-pipe, which conveys the steam away from the cylinder after having performed its office, is inclosed within an external pipe or jacket, leaving a space of about an inch all round; through this space the cold water is forced to enter at one end by the small force-pump, and the boiler is supplied with water by a branch from its other extremity. By thus carrying the water some distance in contact with the hot waite-pipe, through which the steam pusses, it is heated, and a considerable quantity of heat is saved, which would otherwise be lost.

The velocity of the engine is regulated, or its motion can be entirely flopt, if required, by a cock situated in the first passage from the boiler to the four-passaged cock, so as to regulate the passage between the boiler and the cock. The handle of this cock may be connected with a governor, similar to those used in other engines. The construction of the four passages and the cock is exactly similar to what is represented in fig. 6, Plate VII., except that it is placed near the top of the cylinder, because all the lower part of the cylinder is contained in the boiler, and also that the axis of the cock is directed to the centre of the cylinder. High-pressure engines have been sometimes made with beams and parallel levers; but more frequently the cylinders have been placed horizontally, and the piston-rod jointed at once to the connecting rod.

Several very terrible accidents have occurred from the burstling
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burthing of high-pressure boilers, either from their being made too weak to resist the force they are intended to bear, or from some mismanagement, as loading the safety-valve too much. Some years ago, an engine that was employed to drain water from the tide-mills, while building between Woolwich and Greenwich, was blown up by overloading the safety-valve, when several people were killed. Many provisions have been made to guard against these accidents by Mr. Trevithick, who first brought the high-pressure engines into use; at first he proposed inclining the safety-valve in such a manner, that no one could get access to it to increase the load beyond what was intended to be employed. Secondly, he drilled a hole in the boiler, which he plugged up with lead, at such a height from the bottom, that the boiler could never boil dry without exposing the lead to be melted, and consequently making an opening for the steam to escape. This contrivance is calculated to prevent the boiler being burst by suddenly forcing water into it, when it has been allowed by carelessness to boil dry, and become red-hot. A metal plug should always be riveted into such a boiler, as a plug should be made of brass, as the fusing metal, that it will melt whenever the contents of the boiler attain that degree of heat which produces steam of a dangerous elasticity. Another precaution which should always be taken, is to have two safety-valves fixed in different parts of the boiler; so that if by any accident one of them becomes fixed fast in its seat by rust or other means, the other will be in a state to act, thereby diminishing the chance of an accident to half; and the larger the safety-valves are made, the more certainly they will operate. The mercury steam-gauge used in most engines is a long curved tube, or inverted siphon, in which the mercury rises by the force of the steam, and indicates the pressure. If this kind of steam-gauge is applied to the high-pressure engine, it requires a very long tube, which is an additional security against the burthing of the boiler, because the mercury will be blown out of the tube, and permit the steam to escape when the pressure is too great.

Before the boiler of a high-pressure engine is set to work, it should be proved effectually, by drilling small holes through it at different places, so as to try the strength of the metal, and ascertain that it is equal throughout; and then it should be proved by injecting water into it, until the pressure lifts the safety-valve, when loaded considerably more than it is intended to be when the engine is set to work; but this proof should not be too severe, because the metal may be weakened, although it is not burst, by the proof; and, in consequence, may afterwards burst with a much less pressure of steam. At the same time, the engineer who undertakes to make these engines, should fully inform himself of the real strength of metal boilers of determinate thicknesses, which could be easily done, without danger, by injecting water into the boilers until they actually burst. We do not know if such experiments have ever been made; and in those boilers which have been burst by the explosion of steam, the pressure at the moment of the accident has not been known.

We have an account of a trial of a small high-pressure engine made in 1804, in Wales, to ascertain its powers to raise water: the cylinder was 8 inches in diameter, and 4 feet stroke; it worked a pump 183 inches in diameter, and 44 feet stroke, which raised 28 feet high. It worked at the rate of 18 strokes per minute, and consumed about 80 lbs. of coal per hour: this, when reduced, is about 17½ million pounds raised one foot high for each barrel. Thus, the weight of the column is 3266 lbs. for the area of the pump (18.3 x 18.5 = 332.25 x .7854 =) 268.8 square inches x .434 lbs. = 116½ lbs. the weight for every foot of the column x 28 feet = 3266.5 lbs. the total weight of the column. The motion of the piton per minute is (4 x 18 =) 81 feet, or 4860 feet per hour x 3266.5 lbs. = 15,875,160 lbs. raised one foot high per hour. The coal consumed in the hour is 80 lbs.; therefore, as 80 lbs.: 15,875,160 lbs. :: 88 lbs.: 17,462,676 lbs., the number of pounds raised one foot high for each barrel of coal. The area of the piston is (8 x 8 = 64 x .7854 =) 50½ square inches, and the load 3266.5 ÷ 50½ = 65 lbs. preûre per square inch on the surface of the piston.

Manufacture of Steam-Engines.—The great demand for these machines, which has taken place since their value has been so fully understood, has occasioned them to be manufactured in the large way by several engineers, who adopt the same system as is pursued in making of watches and clocks, viz., that of having workmen instructed in making the separate parts, and employing machines and tools for every operation which admits of such aid. The first of these manufactories is that of Melfris. Watt and Boulton, at Soho, near Birmingham, for the manufacture of the inventions and his associate, who established the factory about 1775; and until the expiration of Mr. Watt's patent in 1800, it was the only place where his engines were made. It has continued ever since to furnish the greatest proportion of engines, as well for this country as abroad. There are now other manufacturers who approach the original in the beauty and perfection of the workmanship.

Since the expiration of the patent, there has been a total change in the manner of constructing and putting together every part of the engine, and many advantageous improvements have been made, as far as respects the durability and accurate performance of the machine; though nothing, except the second cylinder of Hornblower and Wooll, has been added to Mr. Watt's engine since he first brought it to a standard, by which its powers are at all increased, with respect to the consumption of fuel, but rather the contrary. At the first establishment of these manufactories, on the expiration of Mr. Watt's patent, many ingenious mechanics attempted to improve the structure of the machine, and the records of the patent office contain more upon this subject than any other. All kinds of parallel motions have been tried; cylinders have been inverted, placed horizontally, made of long and short proportions; large air-pumps have been used; and for the minor parts, such as valves, and the machinery for actuating them, scarcely two following engines were made alike for many years, until by the result of a vast deal of invention and experience, those methods which we have described became settled into established forms; but none of them are superior to the original of Mr. Watt's. Respecting parallel motions, and the proportions of the parts, no methods have been found so good as the original engine; and we accordingly find, that all the most established and experienced manufacturers make engines which are not altered in any great feature from Mr. Watt's original engine, with a beam and parallel motion acting on a simple crank; and they give them all the advantages which can be derived from superior workmanship, and improved methods of putting the parts together, which experience has pointed out.

Melfris. Fenton, Murray, and Wood, of Leeds, Yorkshire, are the manufacturers of the most established reputation after Melfris. Watt and Boulton. The engines they found cannot be excelled in beauty and perfection of workmanship, and they perform as well as any others. Their factory at Leeds is very extensive, and provided with every convenience for making all the parts of the engine in the best manner, and with the least labour. They have three
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Steam-engines in the works, one for boring cylinders, and turning large lathes; a second for turning small lathes, grinding, drilling, the centres of wheels, tapping screws, &c., and blowing the furnaces of the foundry; and a third engine for working a great forge hammer, by which the heavy wrought iron work is forged. The boring machines for cylinders, of which they have three in number, are very capital, as by an ingenious movement, invented by Mr. Murray, for drawing the borer through the cylinder, it is made to advance regularly from one end to the other, without any interruption. These machines are worked by a separate steam-engine, which is never stopped during the operation of boring a cylinder, since it is found to make a tenfold mark on the ring if the motion is stopped. The best means are also taken to prevent the cylinder from changing its figure by its weight, or by the preasure of the parts which hold it in its position. The whole of the factory is lighted by gas lights in winter time. The boilers are manufactured by the aid of several machines to cut out the plate, pierce the holes, and bend the joints. Before any of the smaller engines are sent away, all the parts are put together in a building on purpose, where there are boilers fixed and they are actually tried, to ascertain that every part is perfect; they are then taken to pieces, with a view to instructions for putting them together, and packed up for carriage, which is very easy, as there is a canal at the gates, which has communication by water to every part of England. For such engines as are too large to be put to work at the factory, workmen are sent out with them, to assist and direct in setting them to work.

In London, Mr. Maundley has made many very excellent steam-engines upon the plan represented in our sketch; but his best engine, which is in the saw-mill at Woolwich, is with a beam upon Mr. Watt's plan. He has lately made a large engine, in which he has added an iron frame, in the cold shed, in the iron shed, in the iron shed, and for pieces, with a view to instructions for putting them together, and packed up for carriage, which is very easy, as there is a canal at the gates, which has communication by water to every part of England. For such engines as are too large to be put to work at the factory, workmen are sent out with them, to assist and direct in setting them to work.

Some engineers of Manchester make very good steam-engines, chiefly for the great cotton-mills. At most of the ironworks in the country, and in some of them very capital engines, as at Butteley in Derbyshire, Low Moor in Yorkshire, and others. Their workshops are in general managed by engineers who have been educated at Soho, or at Leeds. Mr. Woolf's engines are made in London by Mr. Edwards, and by himself in Cornwall.

Rotative Steam-Engine. — The reciprocating motion of a steam-engine has always been considered as a great defect; for though all irregularity of motion can be obviated by connecting it with a fly-wheel, yet a great mass of matter must always be kept in a constant succession of changes from rest to motion; and the irregularities which this would produce, can only be governed by putting a great mass of matter in the fly-wheel, and causing it to move with a rapid motion, so that its momentum or vis inertial shall be vastly greater than that of all the reciprocating parts together. With a view of obviating this objection, and of obtaining the action of steam by more simple machinery than a cylinder and piston, many attempts have been made to produce a circular motion at once by the steam, which has been made to blow on the vanes of a wheel of various forms. But the rarity of steam is such, that even if none is condensed by the cold of the vanes, the impulse is exceedingly forcible, and the

experience of steam, so as to produce any serviceable impulse, is enormous. Mr. Watt, among his first speculations on steam-engines, made some attempts of this kind; but he has not given such a description of the valves for this purpose, as to enable an engineer to construct one of them. From any guesses that we can form, we think the machine very imperfect. One of Mr. Watt's first trials was uncommonly ingenious; it consisted of a drum, turning airtight within another, with cavities so disposed, that there was a constant and great preasure urging it in one direction. But no packing of the common kind could preserve it airtight with sufficient freedom of motion. He succeeded by immersing it in the recovery or in an arm, which remained fluid in the heat of boiling water; but the continual action of the heat and steam, together with the friction, soon oxidated the fluid, and rendered it useless. He then tried Parent's or Dr. Barker's mill, inclining the arms in a metal drum, which was immered in cold water. The steam rushed rapidly along the pipe which was the axis, and it was hoped that a great reaction would have been exerted at the ends of the arms; but it was almost nothing. The reason seems to be, that the greatest part of the steam was condensed in a drum kept boiling hot; but the impulse was very small, in comparison with the expense of steam: this must be the case.

Mr. Watt has described in his specification of 1782, lodged at the patent office, some more perfect contrivances for producing a circular motion by the immediate action of the steam. One of these produces alternate motion upon a centre, and is analogous to the double engine; another produces a continued motion. See his first specification of 1769.

We do not find that Mr. Watt has ever erected a continuous circular engine: he has doubtless found all his attempts inferior to the reciprocating engine with a fly. A very crude scheme of this kind may be seen in the Transactions of the Royal Society of Dublin, 1787.

Mr. Cartwright, in a patent of 1797, proposes some improvement of Mr. Watt's rotative engine, but it was never brought into use. Mr. Jonathan Hornblower had a patent in 1783 for a rotative engine, which is the most ingenious of all the speculations on this subject, but too complicated to be carried into execution; and in 1805 he had another patent, for a machine which is quite different from the former, and is ingenious, but still less likely than the first to answer the intended purpose.

Mr. Samuel Clegg has made a rotative engine, the pivot of which makes a complete revolution in a channel at a distance from the centre of motion. We have seen this engine at work, which acted in a very regular manner, but we think the friction must be greater than that of a common engine, although it gets rid of the reciprocation. Mr. Clegg had a patent in 1809 for his invention.

Mr. Turner has lately obtained a patent for a rotatory steam-engine, the principle of which the same as Mr. Clegg's, but each of them has its peculiar advantages in the manner of fitting up, and in the arrangements of its parts. Mr. Turner's is packed in all the moving parts with metallic packings instead of hemp, and we have been informed that his engines operate very well, and without any fly-wheel. Mr. Clegg's engine only requires a small fly at one part of its movement. We think, that if ever rotative engines are brought to perfection, it will be by something of the nature of these two engines, which are the most practicable, and produce greater probability of success than any before invented.

For the application to steam-boats, and to the purpose of drawing carriages, or locomotive engines, as they are now called, rotative engines would be so advantageous, that they would
would be very useful, even though they should consume rather more fuel than reciprocating engines of the same power, provided they were certain in their action.

Cement for making Joints in Steam-Engines.—In joining the flanges of iron cylinders, and other parts of hydraulic and steam-engines, a strong and durable cement is required. The following are receipts for cements proper for such purposes.

Mix boiled linseed oil, litharge, red and white lead, together to a proper consistence: this cement is to be applied on each side of a piece of flange, previously shaped to fit the joint, and then interposed between the flanges, before they are brought home to their place by the screws or other fastenings employed, which will make a close and durable joint. The quantities of the ingredients may be varied without inconvenience, only taking care not to make the mass too thin with the oil. It is difficult, in some cases, to make a good fitting of large pieces of iron work at once, and this renders it necessary sometimes to join and separate the pieces repeatedly, before a proper adjustment is obtained. When this is expected, the white lead ought to predominate in the mixture, as it dries much slower than the red. A workman knowing this fact, can exercise his own discretion in regulating the quantities; but it is safe to have too much rather than too little white lead in the mixture of the cement is not so strong as necessary, only a longer time is required for it to dry and harden. When the fitting will not admit of so thick a substance as flanged being interposed, linen may be substituted, or even paper or thin pasteboard, the only reason for employing any thing of the kind being the convenience of handling.

This cement answers well also for joining broken flanges, however large. Cifererus built of square pieces put together with this cement, will never leak or want any repairs; in the case the flanges need not be entirely bedded in it, for an inch or even less of the edges that are to lie next the water need only be treated, and the rest of the joints may be filled with good lime.

Another cement, which is preferable to the former for withstanding the action of steam, is compounded as follows: Take two ounces of sal ammoniac, one ounce of flour of sulphur, and 16 ounces of caft iron filings or borings; mix all well together by rubbing them in a mortar, and keep the powder dry. When the cement is wanted for use, take one part of the above powder, and 20 parts of clean iron borings, or filings, and mix them intimately by grinding them in a mortar; wet the compound with water, and when brought to a convenient consistence, apply it to the joints with a wooden or blunt iron spatula. —By considering the affinities of these ingredients, those who are at all acquainted with chemistry, will be at no loss to comprehend, that a degree of action and re-action takes place among the ingredients, and between them and the iron surfaces, which at last causes the whole to unite as one mass; in fact, after a time, the mixture and the surfaces of the flanges become a species of pyrites, holding a very large portion of iron, all the parts of which cohere strongly together. Another cement of the same kind is made by mixing together two parts of a mixture of flour of sulphur, and one part of sal ammoniac, and making them into a stiff paste with a little water. When the cement is wanted for use, dissolve a portion of the above paste in urine, or in water rendered slightly acidulous; and to this solution add a quantity of turnings or borings fitted, to get rid of the granular particles. This mixture, spread upon or between the flanges of iron pipes, or put into the interstices of other parts of iron work, will in a little time become as hard as flange.

Mr. Murray's Rule for the Weight of Fly-Wheels to Steam-Engines.—Mr. Buchanan, in his valuable treatise on propelling vehicles, printed at Glasgow in 1816, gives the following rule, as the result of Mr. Murray's long experience in fly-wheel engines.

Rule.—Multiply the number of horse-power of the engine by 2000, and divide it by the square of the intended velocity of the circumference of the fly-wheel in feet per second, the quotient will be the weight of the fly-wheel in hundred weights.

Example.—To find the weight of a fly-wheel proper for an engine of 20 horses' power, supposing the fly-wheel to be 18 feet in diameter, and to make 22 revolutions per second: wheel 18 feet diameter = 56 feet circumference x 22 revolutions per minute = 1232 feet motion per minute ÷ 60 = 20.5 feet motion per second; the motion of the circumference of the fly-wheel. Then 20.5 feet per minute squared = 420.25, and 20 horses' power x 2000 = 40000 + 420.25 = 40420.25 cwt. of the wheel required.

Smoke-Burning Furnaces for Steam-Engines.—The great quantity of smoke which is thrown out by the furnaces of steam-engines, becomes a great annoyance in a town fuch as Manchester or Birmingham, where there are many engines together. To avoid this, as well as from an idea of obtaining a greater effect from the combustion of the smoke, many inventors have been induced to contrive furnaces which shall not produce any smoke. The black smoke which is usually discharged at the top of the chimney, is, in fact, so much good fuel, which only wanted a sufficient heat, and the contact of fresh air, to inflame it under the boiler. It is a fact well known, that the flame which is often seen issuing from the top of the chimneys of foundries, furnaces, &c. has no existence except at the top of the chimney; and that which has ascended, it is only dene, black smoke, containing the azote of the atsmospheric air which has passed through the fire, of hydrogen gas, coal-tar, and carboaceous matter; and this smoke is of such a high temperature, that it only requires oxygen to make it inflame instantaneously: this it obtains from the atmospheric air, into which it descends on issuing from the top of the chimney, and then presents such appearances, as would make a haughty observer adopt the opinion that the flame had ascended, in the state of flame, from the fuel in the furnace, through the whole height of the flue, up to the top of the chimney; but this is by no means the case, and a consideration of this simple fact will convince anyone, that it is not an inconsiderable proportion of the fuel that is thus neglected. Nor is this the only loss sustained; a quantity of heat is required, not merely to render such a portion of the fuel volatile, but to give it a temperature sufficient to produce the spontaneous inflammation at the top of the chimney, of which we have taken notice. This must be furnished at the expense of an extra and unnecessary quantity of fuel.

The first of the smoke-burning furnaces was Mr. Watt's patent of 1785. His method consists in causing the smoke, or flame, of the fresh fuel, while passing from the fire to the flue or chimney, to pass, together with a current of fresh air, through or among fuel which has already ceased to smoke, or which is converted into coke, charcoal, or cinders, and which is intensely hot; by which means the smoke, and groser parts of the flame, by coming in close contact with the intensely hot fuel, and by being mixed with the current of fresh or unburnt air, will be consumed or converted into heat, or into pure flame, free from smoke. This invention is put in practice, first, by stopping up every avenue or passage to the chimney or flues, except such as are left in the interstices of that part of the fuel which is ignited; secondly, by placing the fresh fuel above, or nearer to the external air, than which is burning, and already converted into coke or charcoal; thirdly, by constructing the fire-place in such manner,
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manner, that the fresh atmospheric air which animates the fire, and the smoke or flame which rises from the fresh fuel in the first application of the heat, must pass downwards, or laterally, so as to pass through the whole mass of burning fuel, and ifuse from the interstices of the burning fuel at the most remote part, or internal end of the fire-place, to escape into the flues or chimney. In some cafes, after the flame has past through the burning fuel, it is made to pass up a very hot funnel, flue, or oven, before it comes to the bottom of the boiler, by which means the smoke is still more effectually confined.

This invention of Mr. Watt's has been very extensively practiced; but another plan, by Mr. Robertson of Glasgow, has since been found preferable: it is nearly on the same principle as Mr. Watt's. The opening through which the fuel is introduced into the furnace is shaped like a hopper, and is made of cast-iron, built into the brick-work of the furnace. From the mouth, or entrance of the hopper, it inclines downward to the place where the fire rests on the bottom grate.

The coals in the mouth-piece, or hopper, answer the purpose of a fire-door; and the provision must be attended to in the management of this furnace, that the hopper shall be kept full of coal, either wholly or in part with small coals, to prevent as much as possible the air entering by that passage. The coals which are in the lowest end of the hopper are brought to a state of ignition by the heat of the fire upon the bars, before they are forced upon the bars to be burned.

Beneath the lower part of the hopper the furnace is provided with front bars, which serve to admit air among the fuel which lies upon the grate, and offer a ready mode of forcing the ignited fuel, which has just issued from the lower part of the hopper, back upon the fire-grate, where it is completely consumed, and by thus forcing it back, a space is made, into which fresh fuel falls from the lower part of the hopper; but all the smoke which rises from this fresh fuel must pass through the burning fuel, which lies upon the farther part of the grate, and is thus consumed. By this arrangement, the fuel is brought into a state of ignition before it reaches the farther side of the bottom grate, where it is stopped by a rising current of brick-work; therefore, any part of the coals inherited from the mouth-piece, must pass over these burning coals before it can reach the slot of the chimney; but this, though it would cause a large quantity of the smoke to be burnt, would not completely prevent the escape and ascent of smoke up the chimney; for it is not sufficient that the smoke should be exposed to a heat sufficient to ignite it before it escapes; as, unless a quantity of fresh air, able to furnish a sufficiency of oxygen for the combustion of the smoke, can be brought at the same time in contact with it, it will still escape in an undecomposed state.

The principal merit of Mr. Robertson's invention consists in a judicious admission of fresh air, in such a manner that it can reach the smoke without previously passing through the fire, and parting with its oxygen in its passage, and that it shall be in such quantity, as merely to cause the smoke to burn, and not to cool the bottom of the boiler. Beneath the upper side of the mouth-piece, or hopper, which incloses the fresh fuel, and at the distance of about three-fourths of an inch from it, (this space being a little more or less, according to the size of the furnace,) is placed a cast-iron plate, which is above the hopper containing the fuel; and in the space between it and the top of the hopper is an open space for the admission of a thin stream of air, which, rushing down through the opening, comes first in contact with that part of the fire which is giving out the greatest part of the smoke; viz. the fuel that has been last introduced from the lower end of the hopper upon the grate-bars, mixes with the smoke before it passes over the burning fuel upon the interior part of the grate-bars, where it is in a high state of combustion: this enables the smoke to inflame completely. The quantity of air thus admitted to pass over the upper surface of the fuel newly introduced, is a matter of importance to the complete action of the contrivance. The opening for air is regulated by a very simple contrivance. The plate which forms the upper side of the opening for the passage of the air, rests at each end on a flue, or pin, projecting from the cheeks of the mouth-piece, or it is furnished at each end with a pivot, which works in the cheeks. These pins, or pivots, being placed about half-way between the outside and inside of the mouth-piece, or hopper, by elevating or depressing the outer edge of the plate, the opening for the admission of air between the lower end of the hopper and the lower edge of this plate can be diminished or enlarged. When that degree of opening which produces the best effects is obtained, which is easily ascertained by experiment and kept in its place by means of a piece of iron introduced above it, and answering the purpose of a wedge. These furnaces have been adopted by many manufacturers at Leeds, Manchester, and in London, where many works have been indicted as a nuisance for not having adopted the improvement; the magistrates arguing, that though the welfare of the place required that such inconveniences should be submitted to while no possible remedy for them was known, the health and comfort of the inhabitants equally demand, now that evil can be done away, that smoking furnaces should not be permitted in the place. On this account, Mr. Robertson's furnaces have been very much adopted; but we have seldom seen them in such order as to make any diminution in the smoke, which they will do completely, if the regulation of the quantity of air is properly made.

A recent invention by Mr. John Cutler in 1815, is found to burn the smoke most perfectly in common fire-grates, such as are used for warming apartments; and we have seen an experiment of this plan upon a small-engine boiler, which seemed to promise great success in applying it on a larger scale; but such trials have not yet been made, nor the best form of the apparatus settled.

Mr. Cutler's invention consists in applying beneath the place in which the fire is to burn, a chamber or magazine, which is made as close as can be on all sides, except the top, and is of sufficient capacity to contain within it a magazine of fuel, sufficient to supply the combustion for a whole day, or other required space of time. The fire is made upon the top of the mass of fuel which is contained in the magazine, and there are no grate-bars upon which the fire is to lay; but instead, the bars are placed at the side, in a sloping direction, so as to inclose the fire in a grating, which will admit sufficient air sidewise to supply the combustion. The bottom of the magazine is made movable up and down in the chamber; and by means of a rack and pinion, a screw, or some other mechanical power, the whole weight of coal contained in the chamber can be raised up, and a portion will rise up into the grated part, where air is supplied to it, so that it can burn; for the principle of this invention is to make the magazine-chamber beneath the grate as to exclude the air from it, so that the fire cannot burn the fuel contained in it, and to provide that part of the fire-place which is immediately above the top of the chamber with a plentiful supply of air to burn the fuel. By means of the machinery, any quantity
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quantity of fuel can be raised up out of the magazine-chamber to supply the deficiency occasioned by the combustion.

The manner in which it burns the smoke, is by obliging it to pass through the burning fuel which lies upon the top of the mass of coal contained in the magazine, because this burning fuel communicates sufficient heat downwards to make the smoke rise from the fuel, and this smoke must pass through the fire above it; but before the fuel comes to be actually burned, the smoke is so far extracted, that the coal is in the state of coke.

The machinery by which the bottom plate of the magazine and the fuel contained in it is raised up, is simply an axle, with chains winding upon it; at least that is the contrivance which Mr. Cutler used in the small roofs for warming apartments; but what method will be found best on a large scale, for its application to steam-engines, remains yet to be determined. We shall give a more minute description of this valuable invention under the article Stove.

The Application of the Steam-Engine to propel Boats or Ships.

—This is one of the most valuable applications of the power of steam, next to that of draining mines; and though proposed at a very early period, has been but lately brought into use.

Captain Savery, in 1702, mentions the application of his engine to a ship, but gives no account of the manner of carrying it into execution; probably he only intended it for pumping out leakage-water.

Mr. Jonathan Hull's patent of 1736, for carrying vessels or ships into or out of any harbour, port, or river, against wind or tide, or in a calm, is the first idea of applying the steam-engine to the purpose of propelling vessels. The engine of Newcomen was made to actuate a wheel placed in a frame projecting from the head of the boat, and the oars or paddles of the wheel were to strike in the water, and advance the boat or vessel containing the engine, which would draw after it the ship or vessel that was to be rowed into or out of the harbour. We have no account of any actual trials made by Mr. Hull; but besides his patent, we have a small pamphlet, printed in 1737, with an engraving.

The account which Mr. Buchanan gives of the introduction of steam-boats in his treatise on propelling vessels, is, that Mr. Miller of Dalfinwood, who made many models and experiments with a view to the improvement of naval architecture, appears to have made the first attempt at working a vessel with steam. The vessel was double, with the paddle-wheels in the middle: the experiment, however, did not succeed to his satisfaction.

About the year 1795, lord Stanhope constructed a vessel, which was tried in Greenland: The paddle were made in the imitation of the feet of a duck, and were placed under the quarters of the vessel, but the mechanism did not answer to his lordship's expectation.

In the year 1801, Mr. Symington tried a vessel propelled by steam on the Forth and Clyde Inland Navigation, but it was laid aside, on account of the injury which it threatened to the banks of the canal, by the surge of water which it made. It does not appear that he tried this vessel on any river.

Mr. Symington's steam-boat is slightly described in the Journals of the Royal Institution for 1803, from which it appears, that the method employed by him for making the connection between the piston and the motion of the wheel was by placing the cylinder nearer in a horizontal position. This is attended with several advantages; the necessity for a beam is avoided, which has ever been a troublesome and expensive part of the common engine. The piston is sup-ported in its position by friction-wheels, and communicates, by means of a rod, with a crank connected with a wheel, which gives a motion to the rowing-wheel somewhat slower than its own; the water-wheel serving at the same time as an addition to the fly. The steam-engine differs but little in its action from that improved by Mr. Watt; there is, however, an apparatus for opening and shutting the cock at pleasure, in order to revolve the motion of the wheels, and put the boat back whenever it may be necessary. The water-wheel is situated near the stern, and in the middle of the breadth of the boat, so that it becomes necessary to have two rudders, connected together by rods, which are moved by a winch near the head of the boat: by this means the person who attends the engine is able to steer also.

Another part of Mr. Symington's invention consisted in the application of steamers at the head of the boat, for the purpose of breaking the ice on canals: these were to be raised in succession by means of levers, the ends of which were depressed by the pins of wheels, turned by an axis communicating with the water-wheel. Mr. Symington stated, in a calculation he made, that a boat doing the work of twelve horses, could be built for eight or nine hundred pounds; and he had ascertained by experiment, that it would travel at the rate of two miles and a half per hour. This is a very slow motion, compared with the present steam-boats, as we shall see.

In 1807, Mr. Fulton of New York introduced steam-boats into America, which were the first that succeeded in a large way, so as to become profitable: they had before this been used in America, and were begun there by Mr. Symington. In 1813, a large boat was set to work on the Clyde, in Scotland; and since that time, great numbers have been made both in Scotland and in different parts of England.

There are several different methods of applying the force of machinery to row boats: the most obvious is by means of oars, similar to those with which a boatman rows; but this action is very difficult to imitate by machinery, and has never been brought into practice. Several ingenious schemes may be found in the Machines Approvées par l'Académie.

The next is by means of paddle-wheels, which are similar to an under-shot water-wheel; and when turned rapidly round by the engine, the floats dip into the water, and row the boat along. This plan was first put in practice by the ingenious Captain Savery, in 1702; but to be turned by men working at a capstan instead of a steam-engine, is now adopted in all the real working steam-boats which have been made. Two wheels are usually placed at the sides of the boat, at about one-third of the length from the head. Attempts have been made to place one wheel in the middle of the boat, but they have not succeeded as well as the others.

Another method is by forcing a stream of water out at the stern of a boat by a large pump, which at the same time draws the water in at the head of the boat. This was suggested by Dr. Franklin, after M. Bernoulli, and was very effectually tried by the late Mr. James Linaker, master millwright of the dock-yard at Portsmouth, but found inferior to the paddle-wheels. It has been also proposed to force out air under the stern of the vessel by a pump, but we do not think it likely to succeed.

A fifth method is by a screw applied at the stern of the vessel, and turned round by the engine, or by a row of paddles.

Lastly, various forms of oars have been applied at the stern of the vessel to move from side to side, and impel the vessel on the same principle, as what seamen call sculling a boat, by an oar at the stern.
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As none of these schemes, except the paddle-wheels at the outsidess of the boat, have been brought to any practical utility, we shall not enter into any further particulars, but describe one of the best of these vessels, such as is employed on the Clyde at Glasgow, where steam-boats have been brought to the greatest perfection.

All these vessels are upon one general plan, viz. that of having paddle-wheels, similar to those of steam-water-mills, on each side of the boat, which are put in motion by the steam-engine. In some of these vessels the paddles are placed parallel to the axis of the wheel, in others they are placed obliquely, and in others again they are curved; and it is not yet ascertained which is the best form; for although some boats are found to move with a much greater velocity than others, it is difficult, where so many causes are combined in the operation, to ascertain which one singly produces the advantageous effect. Experiments are yet wanting to ascertain the best number for the paddles on the wheel, and with what velocity they should move. It would doubtless be of advantage to have the means of changing the velocity of the paddle-wheels, according to the circumstances of the current of the water in which the boat moves; because when the boat is moving with the current, the paddle strikes against the water in a contrary direction to its motion, and therefore has the least force to urge the boat forward, at the same time that the boat is moving in the direction of the current, and therefore moves more easily.

On the other hand, suppose the boat moving against the current, the paddles must row the water in the direction of the current, so that supposing they move only with the same velocity, they must have much less force to advance the boat, at the same time that the boat, having to oppose the current, requires a greater force to propel it. One of the steam-boats on the Clyde has eight paddles to each wheel, but it is probable seven would be more efficient; because it is evident, that if too many paddles are used, the water will be so much broken, that it cannot afford that resistance to the motion of the paddle which alone causes the boat to advance. For a small case, suppose so great a number of paddles that they would nearly touch, the wheel would then resemble a solid cylinder, and have no effect to propel the vessel. The velocity with which the paddle strikes the water must be considerable, to obtain a great resistance from the water; but the stroke must not be too frequently repeated, or the weight of the paddle removes will not have time to return to its former place. The fore and aft paddle makes its force known by its stroke, but the paddles of the steam-engine are fitted to the sides, so that all the stroke is necessary to throw the water against the propelling wheel. The paddles are not carried to the bottom of the boat, but to a certain height, as shown in the figure; and the fire-place is an iron tube contained within; I is the fire-door; the smoke, after passing through a small port in the door, gives off through the chimney, C, which is an iron tube, erected perpendicularly in the centre of the vessel, to a considerable height, as shown in the elevation, and is slaved, in the same manner as a mast, by two ropes, or sometimes by iron chains from its top, going fore and aft, with a purchase to each to draw them taut; the fore and rear paddle makes its stroke felt by the paddle wheel, which is made to keep time with the paddle stroke, B, B, and its objects are to carry the steam-box, supplied with steam, and to receive the heated water, G, alternately above and below the piston, so as to give motion to the engine. The steam is made to work on the plan of Mr. Murray’s patent, with the spindle of one through the other. The top of the piston-rod is joined to the middle of a cross-rod, from the ends of which the two iron rods descend, one on each side of the cylinder, and are jointed to the beams, G, G, which are made double, or composed of two levers, joined together in the manner of a frame, so that the cross-iron condensing cistern of the engine is contained between the two, as they work up and down; the beam-centre, or axis of motion, is supported by two bearings, girted up to the bottom of the cistern, so that the beams lie close to each side of the cistern: the cylinder is screwed down into the condensing cistern, and the bearings for the axis of the cross-rod, B, are supported on the other side. The beams, G, G, are united together at the extremity most remote from the cylinder by a cross rod, on the
the middle of which the connecting rod is jointed, which rises upwards to the crank R, on the shaft or axis of the fly-wheel M: this crank-axis is supported in bearings close on each side of the crank, which are framed to the condensing cistern, and also two others at the extremities of the axis, which are placed on the gunwale of the boat, so that the shaft extends completely across the veil, passing through the boiler A, in a tube which extends across it, as shown by dotted lines at a. On each end of the crank-shaft two cog-wheels are fixed, engaging in the teeth of two other wheels, O, O, fixed upon the shafts of the paddle-wheels B, B. These latter-mentioned shafts are each supported in two bearings, one on the outside beam of the gangways or platforms, and the other on the gunwale of the veil: the cog-wheels, O, O, are fixed upon the extreme ends of the shafts within the veil, and they are one-third or one-fourth larger than the wheels on the axis of the crank, so that the paddles do not turn so fast as the fly-wheel of the engine.

It is needless to enter into a description of the action of the steam-engine; the construction of the valves is the same as described in a former part of this article (Plate VII. fig. 5.) and the engine acts the same as Mr. Watt's double-acting engines; but it is necessarily modified, to suit its particular situation, which occasions some defects. The cylinder must be made very short, to come into the height of the boat; and the connecting rod is so short, that the obliquity of its action on the crank is very great. The air-pump, H, is worked by a cross-rod, which moves up and down with the beams, being connected to them by perpendicular rods. The requisite movement is communicated to the valves of the engine by the rod I, one end of which has a circular hoop, that embraces an eccentric wheel, fixed on the axis of the fly-wheel, so that in turning round, it pushes the rod I back and forwards, in the manner of a crank, and thereby alternately opens and shuts the valves at the proper instant to produce the motion.

There is a throttle-valve placed in the steam-pipe at e, for regulating the velocity or stopping the engine, when required.

The arrangement of the apartments in a steam-veilful may be varied according to the purpose for which she is to be employed. In the drawing, we have given the arrangement which appears best adapted for the convenience of passengers, in a veil for quick travelling. (See the plan, fig. 2.) The after or grand cabin, marked 1 in the figure, is generally framed and furnished in an elegant style, for the use of the boat company, who also occupy the deck and gangways about the chimney. The entry to the grand cabin is at the stern of the veilful. The grand cabin is generally situated in the after-part, on account of there being the most room in that part, the engine being always placed considerably nearer the head of the veil than the stern; 3 is a small room for the use of the passengers, and has a door coming out on the gangways. The entry to the engine-house is by steps from the gangway on the opposite side; and the same entry serves for a small room, in which the steward keeps his stores. The coals for working the engine are flowed beneath the floors of the cabins, and the engineer draws them out with a long hook as he wants them. The forward-cabin, 5, is for passengers who pay less than the others; it has a large counter or shelf in the middle, which will contain all the luggages, and serves also as a table for those who fit round it. These passengers have the upper berth in the cabin; but the chimney 1, over the gangways, as at that part are almost entirely occupied by a large water-cask on each side, the cable, stays, falls, or whatever the veilful may require. The rigging of the boat is evident from fig. 1: the carries two large lugger-fails, one fore and the other aft; but these are only intended to be used in fine weather, with a fair and light wind, the masts and cordage being as light as is convenient. A pair of haliards should be provided to the chimney, to hoist occasionally a large light lugger-fail; and if the chiminey is not sufficiently strong, a pair of extra stays may be set up to strengthen it. The chiminey is generally made to lower down, for the convenience of passing bridges, when the veilful navigates a river.

The paddle-wheels of one of the boats on the Clyde, which, Mr. Buchanan says, is considered as a standard, are 8 feet 10 inches diameter, and 4 feet wide, and are calculated, when the engine makes 45 strokes per minute, to move at the circumference, or strike the water at the rate of 13 miles per hour. She is about 80 tons burden, and is 60 feet from stem to stern, and 15 feet 2 inches wide in the beam. The engine is of 14 horses' power, and the goes at an average six miles per hour in still water; therefore, if there is a current, the will go as much faster or slower than six miles per hour as the velocity of the current. The motion of the paddles is rather more than twice that of the boat.

Steam-boats have been built with much more powerful engines, even 20, 25, and 30-horse power; but the increase of the velocity has not been in proportion to the increase of the power of the steam-engines. This will not be surprising, when it is considered that the resistance to which a boat is subject, increases not in an arithmetical proportion, (as 1, 2, 3, 4, 5, &c.) but in proportion to the squares of velocity (as 1, 4, 9, 16, 25.) In other words, to make a fast veifeful move with ten times a given velocity, it requires one hundred times the power; and it is farther to be considered, that one or more powerful engines above mentioned are heavier, and require a greater floating body to support them, which of course increases the resistance. On railways, an increase of velocity requires only an arithmetical increase of power; and to draw a carriage on a railway with ten times a given velocity, would require only ten times the given power.

Steam-boats require a greater power of clearance than any other veifeful of their size, as those hitherto constructed are lees easily transported than veifefals impelled by sails only. The tendency of the wheels acting to the near the centre line of the veifeful, is to propel her straight forward; whereas in turning a sailing veifeful to the wind, she sails her in a curve; and even common oars act far out from the side of the veifeful, that she have much more power to bring her round than the wheels of a steam-boat can possibly have.

A most important point is to have a good steam-engine. All the engines hitherto used in Scotland have been made on Mr. Watt's principle; but those in America have been high-pressure engines, which being more simple, and less expensive, some have been constructed in England. But one of them having exploded in an American boat, the proprietors of some of the English boats have changed their engines for others on Mr. Watt's principle, to avoid similar accidents. We think it quite unjustifiable in any engineer to advise the construction of steam-boats with high-pressure engines, at least for passage-boats, in which so many persons are always assembled together, and so near to the engine, that they would be all destroyed in the event of the boiler bursting.

The engines which work with a bell-crank, or a double beam below the cylinder, and on each side the cistern, instead of a beam working above, are found tostrain the veifefals; those having the beam above, work much more steadily.
STEAM-ENGINE.

steadily. The engines that Meffra, Boulton and Watt have hitherto constructed have had beams; other engines have had cylinders horizontally. Mr. Brunel's engine, of which we have before spoken, has two cylinders acting alternately, so as to require no fly-wheel; but many engines, on the common construction, have been made without fly-wheels, by having the paddle-wheels sufficiently heavy to answer the purpose.

With regard to fuel, it is obviously much more difficult to have every thing kept in proper order in a boat, where the engines are much confined, and the cylinder is made to work with very short strokes, by which the action on the crank is so oblique, and changes its direction so frequently, that the greater part of the power is lost. The quantity of fuel constantly used in steam-boats has been much greater than the usual allowance for Meffra, Boulton, Watt, and Co.'s steam-engines. For one of 14-horse power, they allow 1 cwt. 1 qr. 20 lbs. per hour of good Newcastle coal; but Glasgow coal is much weaker. One of the boats, with an engine of 12-horse power, requires 3 tons 1 cwt. from Glasgow to Greenock (fully 29 miles), and back to Glasgow. One of 15-horse power, and another of 8-horse power, take each the same quantity, viz. from Glasgow to Greenock (26 miles), and back to Glasgow, 1 ton 1 cwt. For farther particulars on steam-boats, see Robertson'sEffay on Propelling Vessels, 5vo. 1816. The Application of Steam-Engines to driving of Carriages.—These are now called locomotive engines, and we may date their introduction with the patent of Meffra. Trevethick and Vivian in 1802, for the high-pressure engines, which were expressly intended for working carriages. It would have been very difficult to have succeeded with any other kind of engine, as the weight of the water necessary to effect condensation must be so great. Mr. Trevethick made a locomotive engine in South Wales in 1804, which was tried upon the rail-roads at Merthyr Tydfil. The engine was the same as that of which we have given an account of its work in speaking of the high-pressure engines, having an eight-inch cylinder, and a four-feet six-inch stroke. It drew after it, upon the rail-road, as many carriages as carried ten tons of bar-iron, for a distance of nine miles; and it performed all that distance without any farther supply of water than that contained in the boiler at setting out, travelling at the rate of five miles per hour.

Since that period they have been tried in many places upon rail-roads, but we do not think they had been really put in practice, to as to work constantly, until 1811, when Mr. Blinkslop, proprietor of the Middleton coal-works, which supply the town of Leeds, adopted them for conveying the coals on his rail-road.

Mr. Trevethick's first engines consisted of a high-pressure engine, with a boiler of caff-iron, of a cylindrical form, five feet long, and four feet three inches diameter, the fire-place being within the boiler. The cylindrical boiler was mounted horizontally upon four wheels, and the cylinder of the engine was placed vertically in the end of the boiler, having two connecting rods descending from the cross-bar of its piston-rod to two cranks, upon an axis extending beneath the boiler and cylinder, and communicating its motion, by means of wheel-work, to the two fore-wheels, upon which the engine runs; and by this means the alternately ascending and descending motions of the piston-rods act to turn round the crank and wheels, and draw the carriage forwards: in this way no fly-wheel was necessary, because the momentum of the carriage to advance itself forward in the road, continued the motion of the wheels and cranks sufficiently to make the carriage pass the line of the centre.

Where these engines were tried, it was found difficult to make the wheels take sufficient hold upon the railway to draw any considerable load after it, unless the weight of the engine and work resting upon the wheels was made very considerable; and then the common iron-rails of the railway were sometimes broken by the pulling of the engine. Mr. Blinkslop, when he adopted the locomotive engine, took up the common rails on one side of the whole length of the road, and replaced them with rails which had large and coarse cogs projecting from the outside. These cogs are called at the same time with the rails, and are hollow beneath, to be as light as is consistent with strength and durability. The pitch of the cogs, or distance from centre to centre, is six inches, so that each rail, of three feet in length, has only six cogs. A wheel, which is fixed on an axis at one side of the carriage, works in the teeth of the rails; and it is turned by wheel-work from the axis of the cranks, the whole machine is caused to advance along the railway. When we saw Mr. Blinkslop's first trial, he employed a small condensing engine, but finding the water to grow to hot that he gained but little by the condensation, he applied a high-pressure engine with a wrought-iron boiler, and two cyliniders in it acting upon separate cranks, so as to produce a constant action to advance the carriage without the necessity of using a fly-wheel.

A similar machine has been tried at Newcastle, but they have attempted to employ the wheels alone, without cogs upon the rails. To relieve the weight upon the rails, and obtain greater re-action to advance the carriage, they applied six wheels for the carriage to run upon; and to make the bearing equal upon all, the two middle wheels were applied to the piston of a small cylinder beneath the carriage, into which steam was admitted, and by its pressure bore up a portion of the weight of the engine; and accommodated itself to any inequalities of the railway.

At present, locomotive engines have been confined to moving upon iron-railways; to make them-engines draw carriages upon public roads, is a refinement not yet attained.

In drawing up this article, we have derived considerable assistance from books, as our numerous references will testify; at the same time we cannot refer to any one work in the English language for a more detailed account of the steam-engine than we have here given. Many detached memoirs on particular points of the principle or construction of the steam-engine, may be found dispersed through the forty-eight volumes of the Philosophical Magazine, and the Philosophical Journal. The first and second volumes of the latter work contain a sketch of the history of the invention, but no particulars which are not given more at large in this article.

The Repertory of Arts, Manufactures, and Agriculture, containing sixteen volumes of the first series, and twenty-eight volumes, now published, of the second series, contains the specifications of a great number of patents for inventions relating to the improvement of steam-engines, of which we have noticed nearly all in this article, which appeared to possess merit, or to have been successfully put in practice.

The article Steam-Engine in the third edition of the Encyclopaedia, which was written by Dr. Robison, is the best and most philosophical view of the subject; but he has not entered at all into details: and as this was composed twenty years ago, the improvements made since that period, in the construction of the machine, have made a total change.

The fullest account of the improved steam-engine is by the celebrated French engineer, M. Prou, who devotes the second volume of his "Nouvelle Architecture Hydraulique," 1796, 9 expressly.
expresly to that subj.. He describes four or five engines, with a great number of large plates, containing every detail of their construction. The work is little more than a description of the plates. These engines are not the best specimens of Mr. Watt's invention; they were all constructed in France by M. Perrier of Paris, who, in 1780, erected a large engine at Chalottet, to pump up the water of the Seine for the supply of the town, and another of smaller dimensions on the opposite side of the river at Gros Caillou. These engines are still at work, and a writer of this article visited them in 1844: they are upon the plan of Mr. Watt's first engines, though, for want of attention to some minute particulars, they do not produce any great effects. M. Perrier had visited England to obtain the requisite instructions for making these engines.

The double-acting engine of Mr. Watt was carried into France by M. Betancourt, whose experiments on the expansive force of steam are referred to in this article. This gentleman came to London in 1788, with a view of collecting models of improved hydraulic machines for the court of Spain, and was admitted to examine the steam-engines made by Meffre. Boulton and Watt at the Albion Mills for grinding corn, which were the first large double-acting engines they had made. M. Betancourt has, in effe&, made a kind of secondary claim to the invention of the double engine, for he informs us, that he knew in part the exterior construction and operation of those machines, but the interior mechanism was so concealed from him, as well as from others who had had the same curiosity before him, that he could only guess at the nature of the construction. He observed, that the chains which were usually applied to the extremities of the beam were suppressed, and that, instead of these, they had applied the parallel motion; that the different parts of the machine were so masked by the distribution of the building, which isolated even the exterior parts into different apartments, as to prevent him from comprehending their correspondence; but, from the result of all his observations, he concluded the machine was of double effect.

On returning to Paris, M. Betancourt made a model of a double cylinder, on a scale of an inch to the foot; and, as he did not know the arrangement of Meffre. Boulton and Watt's valves, he invented those parts himself; and M. Perrier, from this model, constructed a large machine in 1790, at the Hotel Cygnes, in Paris, for grinding corn. By examining the construction of this engine, which is fully described by M. Prony, it will appear that M. Betancourt made good use of his observations, for we find the engine to be the same as Mr. Watt's, in every particular, except in the arrangement of the valves, which part is very defective, as both the steam-pipe and exhausting-pipe must be filled with steam, and emptied at each stroke, in addition to the content of the cylinder, without producing any effect to work the engine. A different construction by M. Betancourt, with two cocks, is also described, but it has the same defect, of which M. Prony was sensible; and in a second machine which he describes, points out the remedy, by varying the arrangement of the valves, so as to bring them very nearly the same as Mr. Watt's, though externally of different appearance. None of these engines have steam-jackets for the cylinders, nor is the expansion principle mentioned by M. Prony. The beautiful contrivance of the regulation by the falling-balls is not described, but all the engines are regulated by a water-cistern and pump, which we have here described. See also Regulator.

It is to be regretted, that none of our experienced engineers have undertaken to write a work on steam-engines, as there is not a single subject in mechanics so interesting and useful.

Almost every introduction to philosophy contains a description of the atmospheric steam-engine, and most of the modern ones a short account of Mr. Watt's improvements; but these are in general very slight and defective; the best is in Brewster's edition of Ferguson's Lectures, which gives a sketch of Mr. Watt's double engine, with the parallel lever and rotary motion; and we believe it was the first description published of that valuable invention, though it had been in general use for twenty-five years before. The engine is clearly described in the British Encyclopedia, 8vo.

Steam-Boiler, in Agriculture, the name of a simple convenient contrivance for preparing different sorts of cattle-food by means of steam, in a small way.

A perfectly convenient and practical contrivance of this kind for farms, where the extent of this sort of food is not required upon a large scale, has been described in the first volume of Communications to the Board of Agriculture: the part in which it is set is of stone or brick, built in a cubical form, about three feet every way; it has the door of a furnace, and an ash-pit: and a shallow iron kettle, about twenty inches in diameter, and seven or eight inches in depth, is placed over the furnace. There is a flat smooth stone covering the whole top part of the building, in the middle of which a round hole is cut out, to admit the iron kettle being fitted closely to it. A cask, the bottom of which is perforated with a number of auger-holes, is placed over the steam-kettle, which is about half filled with water. The cask is then filled with potatoes, and is closely luted or clayed all round the bottom, to prevent the steam escaping between it and the stone: the cover is put on aloof very closely, and there is a short thick plug put slightly in a hole in it, to give air; or this hole may be covered with a piece of lead, fitted closely upon it, and moveable on a leather hinge, that it may of itself give way, to prevent the cask being endangered by the steam. The flue or vent may be built to the wall of any house, or any other convenient place. When the potatoes are steamed or boiled sufficiently, which may be known by taking off the cover, they are either taken out with a shovel, or else the cask is turned over, and emptied into a barrel or tub, and again filled, if necessary. By having it suspended in the middle, on two pins in a frame, it might be made to readily turn upside down, and empty the potatoes or other roots with great convenience.

Though this is a very simple description of steam-boilers, it may be sufficiently to explain the nature of it. But they may be made of various other contrivances, according to the extent required, and one steam-kettle may be made to boil several casks at the same time; or instead of casks, there may be fixed boilers with sliding bottoms, for emptying the potatoes into little wagons, or barrels, wheeled in under. The potatoes might also be taken out of a fixed boiler by means of an iron baleet, made to fit the inside of the boiler; which baleet might be easily taken out with a lever, a small crow, or some other similar contrivance.

And another excellent contrivance of this sort has been made use of by Mr. Stares, which is described in the Annals of Agriculture. But the most complete apparatus for this purpose, where the BUFINa is conducted in a very extensive manner, is that which has been fitted up and described by Mr. Curwen in the fourth volume of Communications to the Board of Agriculture, and which description has been given and recommended to us; in speaking of the use of steaming of cattle-food. It has been suggested, that if steam-boilers be fixed up in a contiguous manner to the kitchens or cellareis of farm-houses, they may be occasionally converted to the use of the families; as this method...
is preferable to the practice of boiling in water for most culinary purposes. See Steaming of Cattle-Food.

Some other very simple and cheap inventions of this kind have also been made and had recourse to in different parts of the country, as will be seen under the head just alluded to.

Steaming of Cattle-Food, the operation or process of preparing different sorts of roots or plants, by means of steam, for the feeding of cattle. It is a practice that may be highly advantageous in such situations and districts as those where both fuel and labour are cheap; but in others it can perhaps seldom be had recourse to with profit. It has been long known that many sorts of roots, and particularly the potatoe, become much more valuable by undergoing this sort of preparation. And it is equally well known, that when thus prepared they have been employed alone as a substitute for hay, and with cut chaff both for hay and corn, in the feeding of horses, as well as other animals. It has, indeed, been observed, that to a farmer who keeps many horses or cattle, or even swine or poultry, the practice of boiling their food in steam is so great a saving and an advantage, that it deserves the most particular attention. It has, however, till lately, been confined to such narrow bounds, that it is known but to very few.

And though potatoes have often been given raw to both horses and cattle, they are found to be infinitely preferable when boiled in steam, as they are rendered thereby much drier, and more nutritious, and better than when even boiled in water; this has been long since flown by the experiments of Mr. Wakefield of Liverpool, who, in order to ascertain it, fed some of his horses on steamed, and some on raw potatoes, and soon found the horses on the steamed potatoes had greatly the advantage in every respect. Thole on the steamed potatoes looked perfectly smooth and sleek, while the others were quite rough. Mr. Ecclestone, near Ormskirk, in Lancashire, also found them useful instead of corn for these animals; and the extensive and accurate trials of J. C. Curwen, esq. have placed the utility and advantage of them in this way beyond all dispute. His statements have been in some measure given in speaking of potatoes. See Potatoes.

It is well known that this, as well as many other sorts of food, may likewise be rendered a great deal more useful and beneficial for feeding and fattening near cattle and sheep by undergoing the preparation by steam. And probably for some other animals.

Mr. Curwen has found, that in their preparation in this way, the waiter of the potatoe is about 3/4th part; and that straw, when given along with them, answers equally well as hay, as the horses keep their condition, and do their work equally well.

The plan of his washing and steaming-house, or apparatus for this purpose, is curious and interesting. It has, in the ground-plan, a well, and a conduit which takes the water from the potatoe washing-machine. The potatoe-washer has a frame, over which a crane moves in a circular manner, which takes the machine out of the tub when the potatoes are wafted, and which empties them into a back, which is raised from the floor the height of one of the steaming-tubs, or will meet another crane, which will place them on the lead-pots, where they are steamed. The two cranes are joined together by a jointed notch, which permits of their being turned, and by which the lead-pot is raised near the place where the tubes stand upon which the steam is let in. There are cocks which let off the condensed water; and a conduit which takes it away. The lead-pots stand upon a framing or platform, which should be ten inches above the floor. There are stone troughs, too, in which the potatoes are bruised for use before giving them to the animals. In the washing-machine, the handle goes twice about for the washer's once. And the crane and jack which wind up the cover is detached from the axle by a jointed notch between the two head-rocks. The water-back is supplied by a spout from a pump, in order to fill the boiler; also, a shorter spout is applied to fill the tub which the washing-machine runs in. It is remarked that a plug is in the bottom of the tub, to let off the dirty water. The boiler consists of two iron pans, screwed together by two flanges; and each pan will hold 40 gallons. The lead-pipe, which leads from the boiler, and conveys the steam to the lead-pots, is one inch and a quarter in diameter. It is noticed that the lead-pots are 12 inches in diameter, and 9 feet in depth. There is a brass cock, which stops the steam when the tubs are taken off; also two other cocks are applied; one to open from the water-back, in order to fill the boiler; and the other to know when the boiler is sufficiently filled with water. There is likewise a steam-valve fixed upon the top of the boiler, of about 4 lbs. to a square inch. The tubs are 2 feet high, and 20 inches wide at the top, and 17 inches at the bottom, and will hold about 11 stone of potatoes.

It is also remarked, that the boiler will steam the four tubs in from 15 to 20 minutes. One or two tubs may be steamed at a time, by plugging up the steam-holes in the lead pots. The tubs are set upon the lead-pots with flannel between, nailed upon the tub-bottom; and each tub-bottom is perforated, to let the steam ascend among the potatoes; and the lids of the tubs are held down by iron ball cleavers, four to each tub. When the potatoes are steamed, the other crane removes the potatoes to the stone trough to be made use of; and also places and replaces the tubs. It is observed, too, that the washer should be about two-thirds filled, and that it will most completely do the potatoes in two minutes. When taken out of the box, it is necessary to either pump or throw a pail of water over them, and to let it drain through them. The fire of the washer must be according to the work required to be done.

Another method has, however, been suggested by Mr. Pietersen of preparing this root, and which he considers as superior in respect to, or so far as the goodness of the food for the use of cattle is concerned, as may be seen under the article Potatoes. This is by means of baking or roasting them in ovens proper for the purpose. The ovens may be constructed in different ways; but that which is here described is three feet six inches by two feet three inches in width, and one foot nine inches in height. It has a cast-iron plate for the bottom, and is provided with flues. The oven, when complete, will contain six digesters.

It may be noticed, that in speaking of the process of baking the potatoes in these ovens, it is observed in the fourth volume of Communications to the Board of Agriculture, that three bushels of potatoes were weighed separately, each bushel weighing 80 pounds before they were put into the digester. The potatoes from the two first digester, taken out of the oven when baked, and weighed together, were 55 pounds; and those from the second two were 54 pounds; and those from the third two, 54 pounds. That the carpenter measured the wood with which they were baked, and he knew that the rated cord of good fuel-wood would bake 90 sets, or 90 times 6 digester, each containing half a bushel of potatoes, at the rate of wood it took to bake the above, which was the second set baked that day. And he adds, that a cast-iron plate five feet long by two feet ten inches, instead of three feet ten inches
inches by two feet ten inches, which will hold eight digester, and by adding a small fire thus,

| Six inches. | Seven inches long, | Six inches. |

on each side the great fire-place, will, in his opinion, accelerate the baking from 15 to 20 minutes in every set, as well as save some fuel.

Also, in a subsequent communication, it is stated that the cord, or, as it is often called, the flack of wood, mentioned in the experiment, is 24 feet long, 3 feet wide, (that is, the wood is first cut into three-feet lengths,) and 1 foot 10 inches high; and is sold for 12s. on the spot in his neighbourhood. Each of the 6 digester holds 6 gallons wine measure, but in potato measure each will only hold half a bushel; so that 1 sack, or 3 bushels, are baked at a time with one part out of 90 of the above cord, or flack of wood. He has never had occasion for more than six bakings in a day; which 6 bakings, that is, 6 sacks, or 18 bushels, at 60 lbs. the bushel, were done within twelve hours, the wood being in a dry state. He believes that eight digester, with the heat properly spread, would be done in somewhat less time, allowing for that of filling and emptying the two additional ones; and this should be sufficiently satisfactory for any person wishing to use the method on a larger scale.

Representations of these different apparatuses for steaming of cattle-food may be seen in the second volume of the "General Dictionary of Agriculture and Husbandry."

There are some other more simple and cheap contrivances in use in different districts for steaming of cattle-food, such as a hoghead cut in halves, the bottom raddled, and mortared half way into a small copper, and coarsely covered with a wooden lid. By this contrivance potatoes are so quickly steamed in Suflex, it is said, that six tubs are done in the course of the day, which is nearly double the number that could be boiled in the water. It is suggested, however, that there should be an easier way of clearing the copper from dirt, which will, in spite of washing, gradually collect at the bottom of it, without the necessity of breaking the mortared joint which connects it and the half-hoghead. Other modes of a similar nature, equally simple and convenient, exist in many other places, which are found to answer perfectly well, where only small quantities of this sort of food are wanted to be prepared at a time.

The steaming of cattle-food is a practice which is yet probably but in its infancy, consequently every discovery of a ready and cheap method of effecting the purpose is particularly deserving of the farmer’s attention, as well as the ascertaining of the improvements which different forts thereby undergo, for the purpose of being applied in the different procédés of feeding and fattening various kinds of animals of the farm fowls.

STEAMING-HO(c)ES, a place properly fitted up for the purpose of preparing roots by steam for the use of cattle. See the preceding article.

STEATITE, in Mineralogy, a mineral particularly distinguished for its unctuous feel, resembling that of soap. That variety which is found in Cornwall differs from common flaxite by the absence of alumine in its composition, and is commonly called soap-flax. See SOAP-STONE.

Steatite is of various shades of white, grey, yellow, and red. It is often semi-massive, and forming incrustations; it is sometimes crystallized; but mineralogists are not agreed respecting the crystals; some considering them as true crystals, others as false ones, formed in the cavities made by pre-existing crystals. The fixated prisms, the rhomb, and fixated pyramid, are considered by Mr. Jameson as sable crystalline; the prisms originating from rock-crystal; the rhomb from brown spar; and the fixated pyramid from calcareous spar.

Steatite is soft, yielding to the nail, but does not adhere to the tongue; the fracture is splintery; it is more or less translucent on the edges, and bears a great resemblance to serpentine; but is much softer than that rock, to which, however, it is nearly allied, being commonly found traversing it in veins.

Steatite also occurs in metasomitic veins, with the ores of copper, lead, zinc, silver, and tin, mingled with albite, mica, and quartz. This mineral sometimes forms beds in primitive mountains. It is infusible by the blowpipe, but changes its colour, and becomes black. According to Klason, the steatite of Bareth contains

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with a trace of lime and muriatic acid.

Steatite has been employed in various countries to answer the purposes of soap and fuller’s earth. The white variety is much valued in the manufacture of porcelain.

The inhabitants of New Caledonia are said to eat considerable quantities of steatite. Humboldt states also, that the Otonnacks, a savage race on the banks of the Oronoco, live for nearly three months in the year principally on steatite, which they bake before using, and then soften with water. Mr. Goldbery says, that the negroes on the banks of the Senegal mix their rice with white steatite, and eat it without inconvenience. Very recently, considerable alarm was excited in the county of Cornwall, on the discovery that it had been the practice of a fraudulent miller in that county to mix a considerable quantity of ground steatite with his flour.

Steatite hardens in the fire, and has been successfully employed in imitating engraved gems, by Mr. Vilcot, an artist in the vicinity of Liege. The subjects to be represented are engraved on it with great ease; it is then exposed to a strong heat. It is afterwards polished, and may be coloured by metallic solutions. A variety of steatite found at Argon, in Spain, is used by artists under the name of Spanish chalk; when gently burned, it is sometimes used as the basis of rouge.

Steatite occurs in Cornwall, in Anglesea, at Porpoze, Ixolmkill, and various parts of Scotland; and in Norway, Sweden, Germany, Switzerland, &c.; and, we believe, in all districts where serpentine abounds. Some mineralogists suppose that steatite is formed from the decomposition of felspar and mica; others, that it is nothing more than decomposed serpentine. See SERPENTINE.

STEATOCELE, from σατυς, fat, and ἤσαν, a tumour, a swelling of the frcotum, containing fat.

STEATOMA, a wen, or encysted tumour, composed of a substance like felt.

STECKBORN, in Geography. See STEKBOREN.

STECKM, a town of Flanders; 5 miles S. of Hulit.

STECKEN, a town of Bohemia, in the circle of Czaslau, 4 miles W. of Polna.

STECKENITZ,
STECKENITZ, a river which rises in the territory of Lubeck, and runs into the Elbe at Lauenburg.

STECZICA, a town of Poland, in the palatinate of Sandomierz, on the Wieprez, near its union with the Wistula; 20 miles W. of Radom.

STE, a provincial term applied to a ladder.

STEBERG, in Germany, a town of the duchy of Carniola; 11 miles E.S.E. of Cirkinitz.

STEERG, a sea-port town of Denmark, on the W. coast of the island of Moen; formerly a place of great strength, with a castle, which has been since destroyed; 38 miles S.S.W. of Copenhagen. N. lat. 55° 3'. E. long. 15° 20'.

STEEL, in the Arts, a most valuable metal, conferring on iron combined with carbon. It is chiefly used for edge-tools, and other cutting instrunents, and from its fine polish is used in ornaments of various kinds.

In chemistry it is called a carburet of iron.

Its hardness is greater than that of iron; and its most valuable property is, that it can be made harder than any other metal, by suddenly cooling it when heated to redness; also, if it is heated to a lower temperature than redness, and suddenly cooled, it becomes the most elastic of all the metals. It is of a darker colour when polished, and retains its polish much longer, than being so liable to oxydize.

The specific gravity of steel is greater than that of iron; thus, the spec. gr. of cast-iron is .7270; malleable iron, .7388; steel in its soft state, .7840; hardened steel, .7818.

Steel is manufactured by two processes, one in which the steel is made from pig-iron at once in the forge; this is practiced in Germany, and is called natural steel. Cemented steel is formed by flattening bars of iron with powdered charcoal in a closed vessel, and by keeping the mass at a brisk red heat for a longer or shorter time, depending upon the size of the bars. This process is called conversion. The test of the conversion being complete is its blistered appearance, from which it has been called blistered steel. As the steel in this change does not undergo fusion, all the imperfections in the mechanical texture of the iron will still be found to exist in the steel. A drawing of the furnace employed for this process is given in Plate VII. Iron Manufacture; for the references to which, as well as the mill for rolling steel, see Rolling of Steel. It is from blistered steel that all the different kinds of steel are manufactured. These are principally of the following varieties, viz., cast-steel and sheet-steel.

Cast-steel is blistered. Steel rolled and cast into ingots, which are afterwards drawn into rods by the hammer, or by rolling. By this change the steel becomes much harder, and of course entirely free from those flaws and other defects which exist in the blistered steel: this is what renders cast-steel so much better for polished goods: for when blistered steel is attempted to be polished, the surface is seen to abound with numerous spots, arising from mechanical defects in the bars previous to conversion.

Cast-steel works much harder under the hammer, and will not bear much more than a red heat, without breaking in pieces under it. This, however, is more especially confined to that commonly made; since cast-steel may be made which will bear a white and even a welding heat; but it requires a much greater heat for its fusion, and would in consequence be sold at a higher price.

The refuse of blistered or common steel is generally melted into cast-steel; but this is not of the best quality. This is generally done by mixing the bars of blistered steel, which, for this purpose, are a little more converted than for ordinary purposes, in order to give the steel a little more carbon than if it were used in the state of blistered steel. The bars are broken into small pieces, for the purpose of flowing the greatest quantity in the crucible.

The furnace employed for melting of steel is the bent constructed air-furnace, and is similar in form to those used by brails and iron-founders in the small way, where the crucible is employed. That part of the furnace containing the crucible and the fuel is of a prismatic form, about twelve inches square, and two feet in length from the grate to the top where the cover is placed. About three inches below the cover is a horizontal opening, called the throat of the furnace, which leads directly into the chimney. This opening is about three inches by six, and must never be less than the open part of the grate. In some manufactories, ten or twelve of these furnaces are at work at one time. The mouths of the furnaces are level with the floor of the room where the casting is performed. These are arranged along the two opposite walls, each containing a flack of high chimneys. The ash-pits of these furnaces terminate in a cellar below, which is well supplied with air. The crucibles in which the steel is melted are made on the spot. The material is Stourbridge clay, to which a little coke-dust is added. They are formed in a mould of cast-iron, of the form of the outside of the crucible. The proper quantity of tempered clay is first put into this mould, and then a wooden plug is driven in to form the inside of the crucible. They are then gradually dried, and slightly baked, at a much less heat than is given to the lofted pots. The crucible is generally removed from the baking fire to the furnace, which would be liable to crack if put into the fire cold. The crucible is placed upon a stand about four inches high, which is also placed upon the middle of the grate. The base of this stand is less in diameter than the upper part, in order to intercept the air the least possible. Each crucible is also provided with a flat cover, made very true on the under side, so as to fit. It is a little larger than the top of the crucible, in order to be easily removed with tongs. The cover is generally made of fire-clay a little more fusible than that of the crucibles. This admits of as much vitrification between the cover and the crucible, before the melting of the steel, as serves to keep out the air, which, at this high temperature, would injure the quality of the steel, by first destroying its carbon, and then oxydizing the iron. In order, however, to guard more completely against this evil, some make use of what is termed a flux. This consists of any easily vitrifying substance, such as bottle-glass, in very small quantity. The flux is usually employed to the blast furnace cinder.

The fuel used for melting steel is the coke of bit-coal, very highly baked in kilns used for the purpose. The fracture of these cokes is white and brilliant. They are so hard as to be fonsorous; and their specific gravity is much greater than ordinary cokes. This coke, being broken into pieces about the size of an egg, is made to surround the crucible closely on all sides, and a few inches above the fame. The heat required to melt steel is so intense, that if the fuel were not firm and dense, the fire would not last till the fusion took place. This would require a supply of cold fuel, which would not only endanger the crucible, but occasion great delay. When the steel is thoroughly fused, the crucible is withdrawn with a pair of long tongs, opening with two concave jaws to fit the cylindrical form of the crucible. The tongs are not removed till the metal is poured. Immediately on bringing it out of the fire, previous to which the cover is removed, some foria, or refiners, are placed on the bars of steel. This exposes the steel to the action of the oxygen of the atmosphere. Particles of the metal are now seen to dart out of the crucible in bright corruptions, and these continue all the time the metal is pouring into the mould, causing a grand and interesting appearance. The mould is
of cast iron, giving an octagonal shape to the ingot. These moulds are of various forms. Those used for steel-plate are in the form of parallelograms: and those for making large faws are smaller at each end, in order to roll out into a plate nearly of the form of the faw.

The steel known by the name of shear-steel, has been so called from its application to the cutting part of sheeple or wool shears. It was formerly manufactured at Newcastle-upon-Tyne, and has been called Newcastle steel. From being subject to a similar process to the natural steel made in Germany, it has also been termed German steel.

We have before observed, that the bar-iron of which steel is made, contains many defects in its mechanical texture. In this state, it is liable to the workmen to lose its strength and become softer; as it is depended upon the management of the bar-iron maker. The manufacture of shear-steel consists in removing these defects, and at the same time giving it what is called increased fibre by the operation of hammering.

The first preparation is to lay a number of bars of blistered steel together, and bind them with iron rings at one end, so that the bars which are put in the fire may not be displaced. A portion of these united bars is now to be heated to a full welding heat, keeping the surface well defended by throwing powdered sand upon it from time to time. This fuses the oxides of iron, forming a liquid coating, which defects the surface from the action of the air. If this precaution is not observed, the steel, when heated to the degree of welding, would become what is termed burnt, and its malleability be impaired. In the welding state it is placed under a forge-hammer, working by water or a steam-engine, when the bars become firmly united, and all the loose parts previously existing in the malleable iron are at the same time made found. When a little more than half the length of the bars is treated in this way, the iron rings are removed, and the other end heated and hammered in a similar way. The welded mafs is now drawn down into small bars about an inch and a quarter broad, and three-eighths or half an inch in thickness. In this state it is sold to the consumer, who afterwards has reduced to different sized rods by the tilt-hammer. The steel is rendered so compact in texture by the welding and hammering, as to become susceptible of a much better polish than blistered steel is capable of; at the same time that its tenacity and malleability are much improved. The former improvement highly fits it for table-knives; the latter makes it valuable for springs of various kinds, particularly those of great power.

The processes by which this steel is formed has another advantage besides rendering it found and more malleable. It is found softer and more kind than the blistered steel from which it is formed, and is much more uniform in its quality. This may be explained by the fact, that a quantity of the carbon of the blistered steel is diffused in the form of carbonic acid during the welding and hammering, by which a steel is obtained, having a less than ordinary proportion of carbon, and is consequently liable to break in bending, and at the same time softer and more flexible. Indeed, if the process of welding and hammering were repeated several times, the steel would lose the whole of its carbon, and become pure iron.

Blistered steel should not be used but for the commonest purposes, where great tenacity of polish is not an object. For all nice purposes, where great tenacity and foundness are necessary, shear-steel should be employed; and where a fine polish or great hardness is wanted, cast-steel is indispensable. See IRON and CULINARY.

STEEL, Annealing, or Nailing of, is for the softening it, in order to make it work easier; which is usually done by giving it a blood-red heat in the fire, and then taking it out, and letting it cool of itself. Some have pretended to secrets in annealing, by which they could bring down iron or steel to the temper of lead; this was to be done by often heating the metal in melted lead, and letting it cool again out of the lead. But this method has no other effect than what is obtained from the former, when the cooling is very gradual.

Steel may indeed be made a little softer than in the common way, by covering it with coarse powder of cow-horn, or hoofs: thus inclosing it in a loam, heating the whole in a wood-fire till it be red-hot, and then leaving the fire to go out of itself, and the steel to cool, which it will do slowly from being inclosed. See TEMPERING, and STEEL, forging.

For the expansion of steel by heat, see PYROMETER.

STEEL-Glaifs, a name given by some authors to the metallic spheres used in optics. These, according to Cardan, are made of three parts of brass, one part of tin, and one of silver, with an eighteenth part of antimony; but most either totally leave out the silver, or add only a twenty-fourth part, to fave the expense. There are many other methods, directed by several authors, but most use arsenio and tartar, mixed with the metals. These are afterwards to be polished with emery, rotten-stone, putty, and the like.

STEEL-Ore, is used to signify a particular kind of lead-ore.

STEEL-Powder. See POWDER.

STEEL, Salt of. See SALT of Steel.

STEEL-Waters. See Mineral Waters.

STEEL, Damaeous. See DAMARCOUS.

STEEL, Engraving on. See ENGRAVING.

STEEL, Faggot of. See FAGGOT.

STEEL, in Medicine. See CHALYBEAT, and IRON, in Medicine.

STEEL-Wine. See WINE.

STEEL-Point, in Geography, a cape on the E. coast of Labrador. N. lat. 56° 42'. W. long. 62°.

STEEL-E, Sir Richard, in Biography, a political and miscellaneous writer of considerable note, was born at Dublin, either in 1671 or 1676. His father, who was of English extraction, had been for some time private secretary to the first duke of Ormonde, through whose influence the son was fend, at an early age, to England, and placed at the Charter-House for education. In 1691 he was entered of Merton college, Oxford. Of his acailmatic life little or nothing is known, except that he composed a comedy during his residence, which, by the advice of a fellow-collegian, he suppressed. He left the university without a degree, and feeling a strong inclination for the army, he entered himself as a private in the horse-guards, but his friends soon after procured for him an ensign's commission. Feeling that he might not be able effectually to reifit the temptations incident to his age and situation, he drew up a little treatise for his own admonition, and which is well known even now, entitled "The Christian Hero," this was printed in the year 1701, at which time the author was secretary to lord Cutts, and had, by his means, obtained a company in a regiment of fusiliers. The serio-comedies of the work expos'd him to some ridicule among his companions, and the more so, as it failed in producing the corresponding good effect in regulating his own morals; he therefore, "to enliven his character," as he says of himself, brought out a comedy, entitled the "Funeral, or Grief à-la-mode." This piece proved successful; it had the merit of uniting entertainment with the more direct purpose of moral improvement, than was usual among dramaticats at that time. Either on this or on other accounts he attracted the notice of king William, who meant to have bequeathed
beffowed upon him some mark of the royal favour, but he did not live to effect his intention. He obtained the very humble office of gazette-writer under queen Anne; but he now pursued his career as a writer, and in 1704 brought out his comedy of "The Tender Husband," which was acted with great success. This was followed by "The Lying Lover," which was not well received.

In 1709, Steele began a series of periodical papers, which, more than any of his other exertions, has contributed to establish his fame. The "Tatler," with which it began, was formed upon a plan which included the political information of a common newspaper. Its main object was, however, to improve the morals and manners, by holding up to ridicule fashionable follies and vices of every kind, and inculcating just and liberal sentiments on common topics, with a general regard to the proper decorum of social life. The author was fully qualified for this task by a knowledge of the world, acquired in free converse with it, by natural humour and vivacity, and by a generous and benevolent way of thinking. He had likewise the felicity of being able to engage coadjutors of considerable talents, among whom were Addison and Swift. The Tatler was extensively circulated, and as, in its politics, it sided with the minister, Steele obtained the reward of a place among the commissioners of the stamp-dues, which he retained after the dismissal of the ministers who had granted it. In 1711 this paper was succeeded by the more celebrated "Spectator," in which the plan was matured, the politics of the day were rejected, and the assiduity of Addison and other eminent writers was more constant, though Steele continued his own most active services. This work was brought to a close, and the "Guardian" commenced in 1713, and was terminated in the same year. He afterwards engaged in other periodical works, but being subverient to more political purposes, they have all been long since forgotten.

On taking a decided political character against the government, he resigned his post in the stamp-office, and likewise his pension, which he had hitherto received, as having belonged to the household of the late prince, George of Denmark. He was now returned member of parliament for the borough of Stockbridge. He had not taken his seat long before he was expelled as the author of certain publications to which his name was prefixed, and which the house, in its great wisdom, voted to be seditious and scandalous libels. The most noted of these, entitled "The Crixa," was not written, but was characterized as a character, and political conduct. The charge exhibited in this occasion, that the libels, as they were called, contained many expressions highly reflecting upon her majesty, &c. maliciously inflaming that the Protestant succession in the house of Hanover is in danger under her majesty’s administration. Steele met with very able as well as zealous defenders in Addison, the Walpoles, lords Finch, Lumley, and Hinchinbrooke; but the party in power was determined on the sacrifice, and the charge against him was affirmed by a majority of nearly two to one. After his expulsion he engaged in some literary undertakings; but on the accession of George I. he was taken into favour, and was presented with a small appointment under government.

Having procured a licence to be chief manager of the royal company of comedians, he had interest enough to get this licence exchanged for a patent for life as governor of that company. In the first parliament of the new reign he re-entered the house as member for Boroughbridge, in Yorkshire; and in April 1715, he received the honour of knighthood, on presenting an address; and about the same time, the more substantial reward of 500l. was given him by Sir Robert Walpole, for special service. Thus encouraged, his fertile pen produced a variety of political tracts in favour of that cause which seemed at all times to be near his heart, as well in its depressed as in its triumphant state. Having been appointed, in 1717, one of the commissioners for enquiring into the estates forfeited by the late rebellion in Scotland, he went to that country, and was treated in it with great respect, notwithstanding the unwelcome news of the errand on which he was sent. It was on this occasion that he conceived the project of forming an union between the Scotch and English churches, and had several conferences with the Presbyterian ministers respecting the restoration of episcopacy; but his zeal, it is said, was not directed by judgment. He obtained, and with much justice, the character of a projector, which was both the effect and cause of that perpetual embarrassment under which he laboured, and which was principally owing to a radical want of economy, and a strange inclination to expences. He was twice married, and with each wife he had a good fortune; yet he seems to have been always necessitous. In 1718 he had a project for conveying fish to market alive, for which he obtained a patent, which, instead of mending his circumstances, only involved him full deeper in difficulties. His biographers observe, that "it was to be wished that his diffidence had occasioned no other failures than that of money; but there is reason to suppose that they sometimes interfered with the dictates of conscience." Whiston says, that once having met with Steele after a vote in parliament contrary to his former declarations, with which he slightly upbraided him, the knight replied, "Mr. Whiston, you can walk on foot, but I cannot." Steele’s spirit was not, however, formed for implicit submission, and for his opposition to the peerage bill in 1719, he was deprived of his theatrical patent. He appealed to the public, and was restored in the following year. He pleaded the cause of the nation by a pamphlet against the Southsea scheme. In 1722 he brought forward his comedy of "The Conscious Lovers," which was received with great applause. He dedicated it to the king, and was remunerated with 500l.; but his embarrassments pressed upon him; and in addition to his other misfortunes, he engaged in an unsuccessful law-suit. Broken in fortune and constitution, he retired to an estate in Wales, where he died in 1729.

He appears to have been much beloved for the benevolence and warmth of his heart; in understanding, he has been characterized as a shrewd and sagacious man; his productions are lively, but they display neither great force nor accuracy. His style and his train of thinking are equally lax and incorrect. He was a lover of virtue, and frequently painted it in pleasing and attractive colours. His reputation as a writer seems to have been much indebted to the partnerships which he formed; and his name is scarcely entitled to a place among those which throw peculiar lustre upon the period of English literature. Biog. Brit.

Sir Richard Steele, without much taste or science in the art, was a musical critic and projector. His divorce on Nicolini, in the Tatler, No. 115, would have done his taste and judgment honour, if he had not afterwards treated opera in general, when they clashed with his interest in the playhouse, with the utmost contempt. He joined with Clayton, Haym, and Dieupart, in a concert at York-buildings, against the opera; and afterwards employed Hughes to alter Dryden’s Ode on St. Cecilia’s Day for music, to let which he employed Clayton but the plan failed. And he had the room in York-buildings afterwards fitted up a considerable expense; and a rotunda erected for himself to read lectures in, on the drama and other subjects. We have heard, or
or read somewhere (we hope not in Joe Miller), that when
the room was finished, he defined the carpenter to mount
the rostrum and speak a few words, loud, that he might judge
what effect the voice would have at different distances; but
the carpenter pleading his inability to say any thing worth
for Richard’s hearing, excused himself as long as possible;
yet sir Richard persisting in his wish to hear a few words
uttered with a loud voice upon any subject the carpenter
might choose, the carpenter, at length, addressing himself to sir
Richard from the rostrum, cries out, with considerable energy,
seasonable elocution, and a loud voice,—“Sir Richard! you have
done me the honour to employ me as your carpenter several
years, without ever asking for your bill; now if you will but
have the goodness to discharge the debt, I should be much
obliged to your honour.”—“Enough, enough,” cries sir
Richard, “the found is not very agreeable; but I believe
it will do.”
Sir Richard Steele was certainly a man of wit and hu-
mour, and in some of his whimsical writings there were good
intentions; but he seems to have been (says Dr. Burney)
unprincipled politician, an occasional Christian, and a pre-
tending, self-interested and ignorant musical critic.
STEELER, in Ship-Building, a name given to the fore-
mast or aftermost plank, in a strake which drops short of the
flem and stern-post, and of which the end or butt nearest
the rabbet is wrought very narrow, and well forward or aft.
Its use is to take out the faying-edge occasioned by a full
bow, or bulbous, circular buttress.
STEELING, in Carley, the laying on a piece of steel
upon a larger mass of iron, to make that part which is to
receive the edge harder than the rest. The body of the axe
may very well be of iron, as it never comes into use to
cut with, and perhaps is stronger, and less liable to break,
than if of steel; but it must have a quantity of steel at that
part where the edge is to be made.
STEELYARD, or STILYARD, in Mechanics, a kind of
balance, called also "fuseta Romana" or the Roman balance; by
means of which the gravities of different bodies are found
by the use of one single weight.
STEELYARD, Construction of the. It consists of an iron beam
A B (Plate XXXVIII. Mechanics, fig. 6.), in which a point
is affixed at pleasure, as C, and on this, a perpendicular
raised, C D. On the shorter arm, A C, is hung a scale or
balance to receive the bodies weighed; the weight I is shifted
this and that way on the beam, till it be a counterbalance
to one, two, three, four, &c. pounds placed in the scale; and
the points are noted in which I weighs as one, two,
three, four, &c. pounds. From this construction of the steel-
yard, the manner of using it is apparent. But the instru-
ment, being very liable to deceit, is therefore not to be
countenanced in commerce.
STEELYARD, Spring, is a kind of portable balance, serving
to weigh any matter, from about one to forty pounds.
It is composed of a brass tube, into which goes a rod, and
about that is wound a spring of tempered steel in a spiral
form. On this rod are the divisions of pounds and parts of
pounds, which are made by successively hanging on to an
hook fastened to the other end, one, two, three, four, &c.
pounds.
Now the spring being fastened by a screw to the bottom of
the rod; the greater weight is hung on the hook, the more
will the spring be contracted, and, consequently, a greater
part of the rod will come out of the tube; the proportions
of which greater weights are indicated by the figures ap-
ppearing against the extremity of the tube.
STEELYARD, Company of the. See STILYARD.
STEELYARD, Chinese. The people of China carry this
fuseta about them to weigh their gems, and other things
of value. The beam, or yard, is a small rod of wood or
ivory, about a foot in length; upon this are three rules of
measure, made of a fine silver-flapped work; they all begin
from the end of the beam, whence the first is extended eight
inches, the second fix and a half, the third eight and a
half. The first is the European measure, the other two
fuseta. At the other end of the yard hangs a round scale, and at three several distances from this
end are fastened so many slender strings, as different points
of suspension. The first distance makes eight-fifths of an
inch, the second is double to the first, and the third four
inches and four-fifths. When they weigh any thing, they
hold up the yard by some of these strings, and hang a sealed
weight, of about one ounce and one-fourth troy weight, upon
the respective divisions of the rule, as the thing requires.
Grew’s Museum, p. 369.
STEELYARD-Song. In the Philosophical Transactions
(No. 462, sect. 5.) we have an account of the steel-yard
spring, proposed as a mechanical method for affixing children
labouring under deformities, owing to the contraction of the
muscles on one side of the body. The crooked person
is supported with cords under his arm, and these are placed
at equal distances from the centre of the beam. It is sup-
posed that the gravity of the body will affect the contra-
icted side, so as to put the muscles upon the stretch; and hence
by degrees the defect may be remedied.
STEEN, JAN, in Biography, one of the brightest orna-
maments of the Flemish School of painting, was born at Ley-
den in 1619. His father was a brewer in that city, who
perceiving an inclination in his son for painting, placed him
as a pupil with N. Knusser, an historical painter at Utrecht.
That he might not be entirely dependent upon his talents
as an artist, his father established him in a brewhouse at
Delft; but this kindness, which might have secured him
comfort, only afforded him the means of sensual indulgence,
by which he was prone, and which, in a short time, led to the
ruin of the concern; and his father finding him irreclaimably
bent on dissipation, at length abandoned him. He after-
wards became a keeper of a tavern; but this was a more
ruinous occupation than the former, and soon brought on
the calamities his conduct merited; as he was said to be a
more active consumer of his own flores than any of his
customers.
Amidst the interruptions of indulgence and of businees,
he continued constantly to prate the art he had acquired;
prentening generally the scenes and subjects in which he
passed his time and were most congenial to him. The fel-
city, frolic, and fun of low life in the alehouse or other
places of public resort, he treated with the clearest expre-
sion and character; and executed them with a pure tone of
colour, and a freedom of touch peculiarly his own. Some-
times, however, he feared somewhat higher, and entering
the domestic circles of his friends, perpetuated with the great-
est felicity the diversities of character and amusements which
pretended themselves to his observant and intuitive eye. In
no man’s pictures is an observer more amused with variety than
in Jan Steen’s; or more entertained by wit and humour,
unless he be in those of our own Hogarth. His drawing
and composition are in general very good, and his colour ad-
mirable, particularly in parts; but oftentimes his manage-
ment of chiaro-scuro is deficient, and his pictures want air.
While he lived, his works were not in much estimation; per-
haps his vulgar and disorderly habits prevented them from
being known; but since his death, and particularly since
for Joshua Reynolds evinced an estimation of them, they have
risen in value, and are now sold, when of fine quality, at very

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great
great prices, and sought with avidity. He died in 1689, at the age of fifty-three.

STEEN, in Geography, a town of Norway, in the province of Agder, 15 miles N. of Christiania.

STEENBERGEN, a town of Brabant, formerly a place of considerable importance, on the sea-side, with a convenient harbour, but now, in consequence of the recedes of the sea, a league from it; and by this circumstance, as well as the calamities of war, reduced so as to have scarcely the appearance of a town; 25 miles N. of Antwerp. N. lat. 51° 37'. E. long. 4° 11'.—Also, a mountain of Africa, near the Cape of Good Hope.

STEENHOUSE, a town of Scotland, in the island of Pomerania; 7 miles W. of Kirkwall.

STEENKERKE, or Steenkerque, a village of France, in the department of the Somme, where a bloody battle was fought by the allies commanded by William III. king of England, with the French under the duke of Luxemburg, July the 24th., 1692, in which the latter were victorious; 13 miles N. of Mons.

STEENKIRK, Steenburch, or Steenkirk, a town of Flanders; 8 miles W. of Dijmude.

STEENPLaat, a town on the W. coast of the island of Gibio. N. lat. 1° 20'. E. long. 127° 21'.

STEENWORDE, a town of France, in the department of the North, and chief place of a canton, in the district of Hazebrouck; 4 miles E. of Cassel. The town contains 347, and the canton 23,650 inhabitants, on a territory of 150 kilometers, in 9 communes.

STEENWYCK, Henry, in Biography, was born at Steenwyck in 1550. He was a scholar of John de Vries, a painter of perspectival and architectural scenes. Steenwyck surpassed his master in the fame subject, viz. interiors of churches and Gothic buildings, which he painted with great neatness and cleanliness. His colouring is rich and brilliant, but he injured his effects by painting the lights too much in lines, unblended and too sharpened, which destroys the appearance of solidity. He died in 1603, and left a son, Henry Steenwyck, born in 1589 at Antwerp, who excelled him in the same line and manner. He usually painted on a larger scale than his father. Vandyck, with whom he lived in intimacy, recommended him to Charles I., who invited him to England, where he resided several years, and died in London. The pictures of both these painters were embellished with figures by friendly artists, as old Franck, Teniers, Breughel, Van Thulden, &c.

STEENWYCK, in Geography, a town of Holland, in the department of Overijssel, situated on the river Aa, in the country of Zallant, and on the confines of Friesland. It has three churches; 55 miles S.W. of Emden. N. lat. 52° 48'. E. long. 6°.

STEEP, in Agriculture, any kind of liquid or other preparation that is used for steeping any sorts of grain or seeds in, which are destined to be sown for raising crops, in order to prevent disease taking place in them. That which is most highly esteemed by the farmer in common, is a very strong solution of common salt in water, such as will keep up a heavy egg upon its surface. Strong stale chamber-ley, in which common salt has been dissolved, is also much used by some farmers in different situations. And there are other sorts of preparations which have been long tried with this view both for feed-grain and small feeds, not without some effect in preventing the danger from disease, as well as from the attacks and ravages of different sorts of insects in the infant state of vegetation and growth in the different kinds of plants as crops.

Several different sorts of preparations, contrived expressly for the purpose of being applied in this way, are given under our articles Pickle, Steeping of Seed-Grain and Seeds, and Turnip-Flies.

STEEP, in Rural Economy, a term sometimes employed to signify the prepared maw-lkin, bag, or stomach of a calf which is killed when suckling. Those in which the calf is perfectly healthy when killed, has been wholly supported with the milk of the cow, and in which there is found a white currly matter to be present, are the best for the purpose, when well prepared by proper salting and steeping in pickle. See Dairying and Kinnen.

STEERP, in Geography, a small island in the Mergui Archipelago. N. lat. 10° 43'.

STEEP Rocks, a ledge of perpendicular shelly rocks, forming, with some interruptions, the W. bank of Hudson's river, for 12 or 13 miles from the Tappan fea, to within 11 miles of the city of New York. Some of these rocks are from 150 to 200 feet high.

STEEP Point, a cape on the S. coast of the island of Java. S. lat. 7° 41'. E. long. 107° 4'.

STEEPHOLM, a small island in the Bristol Channel, about midway between the coasts of England and Wales. N. lat. 51° 10'. W. long. 3° 7'.

STEEPING of Seed-Grain and Seeds, in Agriculture, the practice of preparing wheat, barley, and other sorts of seeds, before putting them into the ground, by means of steeping, in order to prevent disease. It is observed by Mr. A. Young, who has made a great number of interesting experiments in this way, that the effects of steeping, brining, and timing seed-heat, are innumerable, and all equally intended against the smut. From his experiments it seemed that steeping from twelve to twenty-four hours in a ley of wood ashes, in lime-water, and in a solution of arsenic, gave clean crops from extremely smusty feed, but that a short time in these mixtures had a much less effect.

In the northern districts, the practice of steeping is almost in general use with steep of the chamber-ley and salt kinds with lime, and the following are the practices in two of the principal grain districts in the southern parts of the kingdom. It is stated in the Agricultural Survey of Norfolk, that Mr. Robinson, of Watton, for many years has had no other smut on his farm, than what has been caused by accidently fowling a headland, and finishing a corner of a field with dry feed; but if steeped, the prevention is infallible. His method is, to steep it in a brine made with common salt, of strength to bear an egg, for twelve hours, and then to dry with lime. Mr. Dover, of Hockham, had great plenty of pheasants, but lost them all by using arsenic in steeping his wheat-feed. Mr. Salter, of Winborough, however, dresses with salt and lime, without steeping, and never has the smut; it is only to be concluded, that he has always found clean feed. And Mr. M. Hill flake's the lime with salt, dissolved in a small quantity of water; dips the wheat in a steep in plain water only; lays it on the floor, and incorporates it with salt and lime, and then dries it with lime. Mr. Overman finally his feed well in pump-water, then lays it in a heap to drain, and adds half a pound of salt to every bushel, rolls it well together, and dries with lime; this he finds sufficient against the smut. Whence the writer concludes that his feed is always free from that distemper, or affixed he would find the process to fail, for he does not leave it any time limed.

The salt is dissolved in a very small quantity of water; with this salt and water the lime is flaked, and with this fa...
line preparation in its hottest state the wheat becomes can-
died, having previously been moistened for the purpose of
pure water.

Alto in Hertfordshire, Mr. Byde brines his wheat; he
swims it, but takes it out directly and limes it. And about
Theobalds they make a brine with salt, which will swim a
new-laid egg. They leave the feed from two to four hours
long in this brine, and tair and skim it; they lime it over
night, and then sow it next morning, but if it be kept a
week it will receive no injury; they are however not free
from fumit, and have occasionally much over the whole
country, even from Watford. A steeping of one hour is
trusted to at King's Waltham. Sometimes, when the barley is
be added or
thrown on the feed after brining, it kills the wheat. Mr.
Leach has bought fumity wheat to sow for curiosity, and
even the worst which he could find; he steeped it six hours
in a very strong brine, made to swim a large egg; he dried
it with hot lime and fowled it directly, and had no fumit.
He has tried this several times, always with success. He steeped
clean wheat but three hours. But Mr. Sedgwick steeped his
feed in brine above six hours, then dries it with lime and
fows it directly, and he never has any fumit; he omitted it
three or four years, and suffered severely by such omission.

In the Appendix to the Inquiry concerning the Nature and
Causes of the Blight, &c. some useful practical observations
have been infected from Mr. Blackie, the bailiff of the earl
of Chesterfield, on the farm at Bradby-Hall, in Derbyshire.
It is there stated that it has been found by experience, and
is pretty generally known, that fumity feed-grain of the
wheat kind will produce fumity crops; but it is believed,
that it is not generally understood, that the most fumity
feed, by being properly cleaned, will produce clean crops:
such, however, is the fact; it is said; and it has been found
that the purest feed will, by being properly cleaned, or inoculated,
as it is called, with the dfeased, produce fumity wheat-
crops. It is for the naturalist, it is supposed, to affign
a cause why the disease should be infectious; but it is sufficient
for the practical farmer to know that the fact is indisputably
established, and that it is in every one's power to satisfy himself
on the point.

It is noticed farther, that many farmers have felt themselves
disappointed in not having their wheat-crops clear of
fumit, after having been at the trouble and expense of
changing the feed, and even washing and steeping or brining
that feed, not being aware of the infectious nature of
the disease against which they were guarding; and that the
very means they were taking to clean the feed, were also perhaps
the means of inoculating, impregnating, or infecting
it with the fumity matter. For after the operation of steeping
or pickling is performed, the feed is generally spread
out on the barn-floor to drain, and probably on the very
fame floor where fumity wheat had previously been threshed
out; or perhaps the feed is put up into sacks in which had been
fumity wheat but a short time before. The inoculation
or infection is then, it is said, complete; the feed is
fowled; the produce will inevitably and invariably prove
fumitted; and the farmer naturally feels himself disappointed,
after all his attention, trouble, and expenditure. It would
also, it is said, be prudent in every farmer to see to the
washing and steeping or pickling the feed himself, for if he
trust that operation to servants, he will generally find himself
disappointed.

It has been known that some farmers sow the same wheat
for a succession of years, and with very little preparation or
cleaning of the feed, yet have no fumit in their crops; and
so they may with safety continue to do, so long as they keep
clear of the infection, by not borrowing or lending sacks,
by change of barn, or implements, or of other things em-
ployed about it. It is suggested, that the infection is also
sometimes probably carried from the barn-door, when the
dung is taken green to the fields, without being properly
turned and fermented. It is likely too, it is said, that
there are various other ways by which the infection is com-
municated, but which the careful farmer will guard against,
when he becomes more sensible of the contagious nature of
the disease.

In the result of two experimental trials, which were
made in the years 1807 and 1808, on the same farm, under
the patronage and inspection of the noble owner, there is
much certainty and satisfaction afforded on this important
and interesting subject.

In the first trial, it is said that in the autumn of the pre-
ceding year, his lordship bought a peck of very fumity dis-
 eased wheat from a neighbouring farmer, who had that year
great losses in his crop from fumit. A piece of land was then
set apart for the trial; one half of the wheat was sown in the
state in which it was bought, and the result proved, it is said,
as might be expected, two-thirds of the produce being fumit.
The other half peck was washed as clean as possible, chang-
ing the water three times, and then put into a brine or steep
some time enough to carry a new-laid egg, in which it remained
two hours, being stirred up twice in the course of that time;
when taken out it was dried over with quick-lime, and
fowled on the other half piece of land; the result, it is said,
proved entirely satisfactory, as it produced a full crop of
fine wheat, without a single ear of fumit.

In the second trial, in the preceding autumn also, his
lordship, by way of change in the feed-grain, had the whole
of his feed-wheat from Dunstable: it was fine, it is said,
and perfectly free from fumit. Six ears of the fumity kind
were fawed from the crop of the preceding year's trial;
they were put into a small bag, and rubbed therein; the
fumity grain was then carefully shook out of the bag, so
that there only remained the black duft: a quart of Dun-
stable wheat was then taken, and although perfectly clean
at the time, was washed in three waters, and then put into
the fumity bag for the purpose of inoculation, or being im-
regnated with the infection; it was shook in the bag, in
which it remained two days, and was afterwards sown. The
result is stated to have been highly satisfactory in proving
the effect of inoculation, as a very great proportion of the
produce was entirely fumit; while out of twenty acres sown
with the same feed-grain not inoculated or infected by the
fumity matter, not one fumity ear was found, although care-
fully examined expressly for that purpose.

These trials are said to be known, and to have been seen
by many farmers and other persons in the neighbourhood.
And that the inoculated wheat, on being cut and carefully
threshed out, was kept for the purpose of being flown to
any person who might think it worth while to examine it.

It is further noted, that since the advance in the price
of salt, the expense of good brine for steeping or pickling
feed-wheat has become a consideration to farmers, and that
in consequence, various substitutes have been adopted, fre-
quently not efficacious.

It is thought too, that it would be very advisable, in ad-
dition to all other precautions, that the feed should be well
washed, and all the refuse scummed off from the surface of
the liquid made use of for that purpose.

All above observations and results are strongly enforced,
and flown to be correct by the following statement. In the
autumn of 1805, after having finished the wheat-feeding on
the above farm, a neighbouring farmer was advised to feed
for the steep or pickle which was left. He has suffered
much
much in former years from the smut, and previous to his fencing for the pickle, had that year four half of his wheat field drained or flaked in his usual way; the remainder of the seed was well washed, was steeped or pickled, and proper precautions taken in the manner directed above; the result was quite satisfactory, as the crop from the first fown seed proved full of smut; whereas there was not one smutty ear to be found among of the latter fown seed.

On the nature and cause of the disease there are so many notions and opinions, that, it is said, one farmer fits down contented with his crop of flaked wheat, under the idea that it has been caused by something pernicious in the atmosphere; another thinks that it is owing to the nature of the soil, which he concludes to have always grown smutty wheat; and a third, who is better informed on the matter, conceives that it proceeds from the feed, which, though brought from a distant district for the sake of change, and appearing to be pure feed, yet was the means of commenting the smut, contends that it is of no use to change the feed, as he is still liable to get smutty wheat; various other causes of the disease are also maintained by others, which need not be here noticed.

It may be reasonably concluded, that it has surpassed the writer much, that sensible practical farmers and agriculturists should still remain so greatly prejudiced, even against their own interests, as not to endeavour to eradicate or remove this pernicious disease, when it is certainly within their power so to do. The means by which it is thought possible to accomplish so desirable an object, are, it is said, first to impress on the minds of all such persons, that the disease originates with the feed; secondly, that it is in a high degree infectious; and, thirdly, that the same preventive and cure are to be effected by proper care and attention to the established practices of well washing, and bruising, steeping, or pickling the feed.

In short, there has been such a variety of contradictory opinions and conclusions entertained in relation to the use and efficacy or advantage of steeping and preparing feed-grain, that nothing could hitherto scarce be attempted or established upon any thing like a satisfactory or scientific basis; but the result of the whole of what has been stated from the above experiments and trials would seem to direct and lead to greater correctness and certainty in the principles and practice which are to be pursued, as it shows, that the disease to be guarded against by them is of a very infectious kind, even when in the smallest and most minute portions of the seed-grain, and probably that the infection lies in the black powdery matter which adheres to the grain; consequently that every sort of washing, steeping, and perhaps rubbing, may be of some benefit, but especially the two first, when performed with sufficient care, attention, and caution in every way, and for a proper length of time. When, in spite of such care and precaution, some ears of a crop may become diseased, it must be the consequence of some minute particles of this black powdery material still adhering, in defiance of every effort for their removal, to the feed-grain.

The accidental occurrence of the disease in such cases, may, however, as has been seen, sometimes originate from incaution and the imperfect execution of the means which are made use of for the purpose, in the barns or other familiar places, as well as from slight portions of the powder substance being incalculably carried or conveyed into the fields in a variety of different ways, as by the facks with the grain, the hoppers, the feed-lips, and numerous other modes.

In regard to the use of steeping feeds of the turnip and other small field kinds, it has been noticed by a late writer on agricultural chemistry, that these are different preparations and menstrua of the chemical kind which render the process of sprouting or germination much more rapid than usual, when the seeds have been steeped in them. As in these cases the feed-leaves are quickly protruded and produced, and more speedily perform their functions, it was proposed as a subject of experiment to examine whether such menstrua and preparations might not be useful in raising the turnip in a more speedy manner to that state in which it would be secure against the attacks of insects, especially the fly, which is so destructive to it; the result, however, it is said, proved that the practice was inadmissible; as seeds so treated, though they germinated much quicker, did not produce healthy plants, and often died soon after sprouting.

In the month of September 1807, radish-feeds were steeped for twelve hours in a solution of chlorine, and similar feeds in very dilute nitric acid, in very dilute sulphuric acid, in weak solution of oxy sulphate of iron, and some in common water. The feeds steeped in solutions of chlorine and oxy sulphate of iron, threw out the germ in two days; those in nitric acid in three days, in sulphuric acid in five days, and those in common water in four days. But, it is said, in the case of premature germination, though the plume was very vigorous for a short time, yet it became at the end of a fortnight weak and sickly; and at that period less vigorous in its growth than the sprouts which had been naturally developed, so that there can be scarcely, it is thought, any useful application of these experimental trials. Too rapid growth and premature decay seem invariably, it is supposed, connected with organized structures; and that it is only by following the new operations of natural cauuses, that we are capable of making improvements. See Tunntre.

However, if the result of these trials should be confirmed by further ones, and more full and complete experience, although steeping feeds of these kinds in these sorts of preparations may not be capable of being usefully had recourse to in the above intention, it may often be beneficial for promoting the healthy sprouting and early growth of these and many other sorts of small seeds in very dry times and hot parching seasons, as well as, in common water, for dwarfing them of various sorts of extraneous matters and light in imperfect seeds. Many of the preceding observations may be applied with advantage by the gardener, in steeping peas and beans, &c. as well as the nuts, kernels, and frames of many different sorts of plants and fruits.

STEEPLE, an appendage generally raised on the western end of a church to hold the bells. Steeples are denominated from their form, either spires or towers. The first are such as ascend continually, diminishing either conically or pyramidal.

The latter are more parallelepips, and are covered at top, platform like.

In each kind, there is usually a fort of windows, or apertures, to let out the sound; and so contrived, at the same time, as to drive it down.

Mafius, in his treatise of bells, treats likewise of steeples. The most remarkable in the world is that at Pisa, which leans all to one side, and appears even now ready to fall; yet is in no danger. This odd disposition, he observes, is not owing to a shock of an earthquake, as is generally imagined; but was contrived for at first by the architect; as is evident from the ceilings, windows, doors, &c. which are all in the level.

STEER, Hog-starr. See HoO and Ox.

STEERAGE, in a Ship, that part of the ship shaft where
where the tiller traverses between decks. In merchant-ships, it is the space between the companion-ladder and the captain's cabin. In large ships of war, it is used as a hall, through which it is necessary to pass to or from the great cabin. In merchant-ships, it is generally the habitation of the inferior officers and ship's crew.

**STEEERING** is also used to express the act of directing a ship's way from one place to another, by means of the helm and rudder, or of applying the efforts of the helm to regulate her course when the advances.

He is held the best steerman, who uses the least motion in putting the helm over to and against, and who keeps the ship left from making yaws; that is, from running in and out.

For this purpose the helmsman should diligently watch the motion of the head by the wind, and, seeing the wind is fair or large, give the proper indications by the helm or rudder. He should note the effect the helm has on the ship's movement, and use the least amount necessary to bring the ship up to the desired course.

The steering wheel, in **Ship-building**, is the wheel on the quarter-deck, to which the tiller is connected by a sufficient number of turns round its barrel, by turning of which the helm is moved from one side to the other with the greatest ease.

**STEERING**, in **Rural Economy**, a term applied to young growing oxen, in contradistinction to **OXEN**.

**STEEVENS, GEORGE**, in **Biography**, the most successful of all the editors and commentators of Shakespeare, born at Poplar in the year 1725 or 1726, was the son of an East India captain, afterwards a director of the company. The subject of this article received the elements of his education at King's College, Cambridge, and having acquired a large portion of classical literature, with a general taste for learned pursuits, he devoted his time and fortune to the study and collection of books.

On the first establishment of the **Essex militia** he accepted a commission, but he spent the concluding years of his life in almost total seclusion from the world, seldom mingling with society, but was found either in the shops of booksellers, in the Shakespear gallery, or in the morning conversations of Sir Joseph Banks.

Although not an original writer, he deserves a place among the chief literary characters of the age, considering the works which he illustrated, and the learning, sagacity, taste, and general knowledge which he constantly exhibited in his writings. With a great versatility of talents, he was eminent both by his pen and pencil; but his chief excellence lay in his critical knowledge of an author's text; and the best specimen which he gave of his great talents is his edition of the works of Shakespeare, in which he is said by competent judges to have left all competitors far behind him.

He had studied the age of Shakespeare, and employed a very large portion of his life in becoming acquainted with the writings, manners, and laws of that period, as well as the provincial peculiarities, whether of language or customs, which prevailed in different parts of the kingdom, but more particularly in those in which Shakespeare lived the early years of his life. He was continually increasing this store of knowledge by the acquisition of the obsolete publications of a former age, to obtain which he spared no expense. His critical sagacity and observation were constantly employed in calling forth the hidden meanings of the dramatic bard. In preparing his last edition for the press, he gave a very singular example of diligence and perseverance. To this work he exclusively devoted a period of full eighteen months, during which he left his house at Hampstead every morning at one o'clock, and coming to London, without any regard to the weather, or the season of the year, he found a proof-sheet of Shakespeare ready for his perusal and correction. Thus, while the printers slept he was awake, by which means he completed in about the time already mentioned his splendid edition of the works of Shakespeare, in 15 vols. 8vo.

Mr. Steevens died in the year 1800, at the age of about 65 years. He bequeathed his valuable copy of Shakespeare, illustrated with 300 prints, to Lord Spencer; his Hogarth, which was perfect, with the exception of two prints, he bequeathed to Mr. Windham; and his corrected copy of Shakespeare, with 200 guineas, he left to Mr. Read, at whose chambers he always corrected the proofs of his work in the silence of night.

Mr. Steevens was a man of great wit, and indulged his propensity freely, not only in conversation, but in various other modes in which he threw ridicule upon some of his antiquarian friends, whom he was fond of leading into errors. "His satire was severe and not without malignity, and his character seems to have been far from amiable, though he is said to have been bountiful, on many occasions, to perfons in distress." He was indefatigable in every thing which he undertook, but subject to caprice in his habits and attachments.
the elevation of a ship's cathead or bowsprit above the stem, or the angle which either makes with the horizon.

STEVING, in *Merchant Ships*, is used for the flowing of cotton or wool, by means of sclers, to force it closer together.

STEFANO, called *Il Fiorentino*, in *Biography*, is the only one of Giotto's scholars who aimed at something beyond the mere imitation of his master, whom, according to Valari, he surpassed. He was born at Florence in 1301, and was the grandson of Giotto, by a daughter called Caterina. He was the first who attempted foreshortening; and if he failed of complete success, he certainly corrected perspective, and gave more varied turns, more character, and greater vivacity to heads. His most accredited works in the church of Afa Celi at Rome, Sta. Spirito at Florence, and elsewhere, are no more. No authentic record of his remains, unless we except a Madonna in the Campo Santo at Pisa, undoubtedly in a greater style than the works of his master, but retouched. He died in 1350, aged 49. Fueller.

STEFANO, TOMASO, according to Baldinucci, was the son and disciple of the foregoing artist, and born at Florence in 1324. He acquired the name of Il Giottino, from the great reemphasis of his works to those of Giotto. A Pia, which still remains of him at S. Remigio at Florence, and some frescoes at Assisi, bear indistinguishable marks of that style. He died at Florence, at the age of 52.

STEFANI, AGOSTINO, a disciple of the elder Bernabei, was born in 1615. Though Walther and most of the Germans, who wish to rank him among their countrymen, say that Leipzib was the place of his birth; yet Handel and the Italians make him a native of Castello Franco, in the Venetian state. He was a chorister at St. Mark's during his youth, where his voice was so much admired by a German nobleman, that, obtaining his dismission, he took him to Munich in Bavaria, and had him educated, not only in music under the celebrated Ercole Bernabei, but in literature and theology sufficient for priest's orders; in consequence of which, after ordination, he was distinguished by the title of abate, or abbot, which he retained till late in life, when he was elected bishop of Spiga. In 1674, at the age of 19, he published his "Psalms," in eight parts. He likewise published "Sonate a 4 Stro-menti," but his chamber duets are the most celebrated of his works, and, indeed, of that species of writing. In his little tract, "Della certezza Del principij della Musica," he has treated the subject of musical imitation and expression, according to P. Martini, like a philosopher, and agreeable to mathematical principles. This work, written in Latin, which we have never seen, was held in such high estimation in Germany, that it was translated into the language of that country, and reprinted eight several times. Walther and Marpurg have given the following list of Italian musical dramas or operas, which the admirable Stefani set for the court of Hanover, where he resided many years as maestro di capella: "Alejandro," "Orlando," "Enrico," "Alcide," "Alcibiade," "Atalanta," and "Il Triunfo del Faro," which were afterwards translated into German, and performed to his music, between the years 1655 and 1660, at Hamburg. About the year 1724 he quitted the court of Hanover, when he is said to have resigned his office as maestro di capella in favour of Handel. He was elected honorary president of the Academy of Ancient Music in London. In 1725 he went into Italy, to see his native country and relations, but returned the next year to Hanover. However, soon after, having some business to transact at Frankfort, he was there seized with an indis-}

position, of which in a few days he died, at near fourscore years of age. There are perhaps no compositions more correct, or fugues in which the subjects are more pleasing, or answers and imitations more artful, than are to be found in the duets of Stefani, which, in a collection made for queen Caroline, and now in the possession of his majesty, amount to near one hundred. The greatest fingers of Italy during the last age used to exercise themselves in these duets, as folleuggi. Mrs. Anne, the widow of Dr. Arne, and scholar of Gemignani, who sung in fewer of Handel's latter operas, has frequently assured us, that she had often heard Scuclino, the Strada, and other eminent opera singers, sing them during their morning studies. They were then in the best melody of the times; but, at present, there are very few passages which opera singers would be likely to meet with in parts of the operas of the present day.

STEFT, in *Geography*, a town in Germany, in the principality of Ansbach; 3 miles S.S.W. of Maynernheim.

STEG, in *Rural Economy*, a provincial term sometimes applied to a gander. Stegs which are of some age are always better than such as are too young, in the management of geese and their young flocks.

STEGETANIA, in *Botany*, so named by Mr. R. Brown, from *styga*, closely covered, is a genus of ferns, separated by that learned botanist from *Blechnum* and *Pteris*, in his Prodr. Nov. Holl. v. 1. 152. Its character is made to consist in the linear assemblages of capules, *Sori*, covering the frond, or the contracted fructifying portions of it, entirely, the involucrum being marginal, opening at the inner edge, and uninterrupted. The habit of the genus, of which eight New Holland species are defined in the work above cited, is said to be like *Blechnum*, while the character is not always distinguishable from that of *Pteris*. It is hinted that *Blechnum boreale*, Fl. Brit. 1135, and *Pteris crispis*, ibid. 1137, may perhaps belong to *Stegania*. A genuine example of this genus is, however, *Onoclea nuda*, Labill. Nov. Holl. v. 2. 96. t. 246. *Blechnum procumbens*, ibid. t. 247. *Stegania procumbens*, Br. n. 8, seems, by the figure, to be a real *Blechnum*, the infestation of the involucrum being not strictly marginal, scarcely more so indeed than in *B. boreale*, of whose genus we cannot entertain a doubt. In this state of things we hesitate to admit *Stegania*, left all its species, if examined at a proper period of growth, should prove to have an involucrum not originating from the margin, however near that part it may be inferted.

STEGANOGRAPHY, *στηγανογραφία*, formed from *στηγανό*, secret, and *γραφία*, to write, the art of secret writing, or of writing in cyphers; known only to the persons corresponding. See CIPHER and DECHERERING.

STEGEBORG, in *Geography*, a town in Sweden, in East Gotland; 8 miles N. of Calmar.

STEGEN, a town of Norway, in the diocese of Drontheim; 100 miles N. of Drontheim.—Alfo, a town of the duchy of Holstein; 15 miles S.E. of Braemsted.—Alfo, a small island in the North sea, near the coast of Lapland. N. lat. 67° 30'.—Alfo, a town of Prussia, in the province of Natangen; 14 miles S. of Braunsburg.

STEGNOSIS, *στεγνώσις*, an obstruction of any natural discharge, especially that by the pores.

STEGNOTICS, *στεγνώτικα*, formed from *στεγνό*, close, *con spirao*, I close, in *Medicine*, remedies proper to close and stop up the orifices of the vessels, or emunctories, when relaxed, stretched, lacerated, &c.

Such are pomegranate leaves, red roses, plantain leaves, tormentil roots, &c. Stegnotics are proper in the hemorrhoids, and other fluxes of blood.

STEGOSIA,
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STEGOSIA, in Botany, so called by Loureiro, Fl. Cochinch. 51. from creos, a roof, is a genus of grallae established by that author, which proves not distinct from Rottbollia. (See that article.) The original specimen of Loureiro's only species, sent by him to Sir Joseph Banks, was found by Mr. Brown to be R. casperata, Linn. Suppl. 114. It is used in Cochinchina for thatch.


STEN, in Geography, a town and fortress of Bades, on the east side of the Rhine; 4 miles S. of Worms. — Alfo, a town of the duchy of Baden; 3 miles E. of Carlribe. — Alfo, a town of the duchy of Carinthia, with a castle, on the Drave; 2 miles S. of Chagensfurth. — Alfo, a town of Saxony, in the lordship of Schonburg; 7 miles S.E. of Zwicau.

STEIN, or Kamnetz, a town of the duchy of Carniola, on the Feilir; 10 miles N. of Laybach. N. lat. 46° 22'. E. long. 38° 20'.

Stein am Rein, a town of Switzerland, in the canton of Zurich, situated on the north side of the Rhine, at the west extremity of the lake Zell, with a bridge over the river. This town was surrounded with walls, in the year 966, by Burcard, the second duke of Swabia, who endowed it with several privileges; and in the year 1005, the convent, founded by his consort at Hohenweil, was removed to Stein, and continued in this place, under the government of an abbot, till the time of the reformation. In 1437, the town devolved upon the family of Hohenklingen, and in 1435, both the seat of that name, which is still standing above the town, and the town itself, was sold to the Klingen family; and in 1457, the burghers redeemed themselves, and soon after entered into an alliance with Zurich and Schaffhausen. In 1484, retaining their liberties and privileges, they put themselves under the protection of Zurich, as they continue to this day. At the period of the reformation, Stein, in conjunction with most of its contiguous titulars, embracing Protestantism, the convent was suppressed; and in 1524, Zurich appointed a bailiff to superintend and collect its revenues. The high and low jurisdiction is lodged in the town, the magistracy of which is composed of burgomasters, and a council, who are all natives, and of its own nomination; excepting the judge and his conseiller, who are appointed by the city of Zurich, though even these must be burgesses of Stein. The fore-mentioned seat of Hohenklingen is converted into a watch-tower, and the caffellian refides in it. On the other side of the Rhine, in a place called "Burgh," opposite to the town, is a church, seated on an eminence, and belonging to Stein. Some are of opinion that this is the site of the castle of a Celtic town, called "Gauonduriam," which is supposed to have extended to the village of Eschenz; 10 miles E. of Schaffhausen. N. lat. 47° 39'. E. long. 8° 50'.

Stein, a town of Germany, in the margraviate of Anspach, on the Redneck; 28 miles E.N.E. of Anspach.

See Stein.

STEINA, a town of Bavaria, in the bishopric of Bamberg; 6 miles W. of Burg Eberach.

STEINACH, a town of the duchy of Steiria; 11 miles W. of Rottenmann. — Alfo, a town of Lechens, which runs into the lake of Constance, 2 miles W. of Rofbach. — Alfo, a town of Bavaria, in the bishopric of Bamberg; 2 miles N.E. of Burg Eberach.

STEINACH, or Stadt Steinach, a town of Bavaria, in the bishopric of Bamberg; 30 miles N.E. of Bamberg. N. lat. 50° 11'. E. long. 11° 37'.

STEINACH, a town of the duchy of Wurzburg; 5 miles N. of Munderhaut.

STEINACH, Ustra, a town of Germany, in the principality of Coburg; 5 miles E. of Bayreuth.

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STEINACH, a river of Wurtemberg, which rises S. of Neifen, and runs into the Neckar, near Nurtingen. — Alfo, a river which runs into the Maine, 1 mile S. of Zeulen, in the bishopric of Bamberg.

STEINACH, Markt, a town of the duchy of Wurzburg; 3 miles E.N.E. of Schweinfurt.

STEINACH, a town of Ania, on the Little Erfall; 10 miles S. of Ips.

STEINAM ANGER, or Szombathely, a town of Hungary, built on the ruins of an ancient Roman town, called "Sabaria;" 48 miles S. of Vienna. N. lat. 47° 50'. E. long. 16° 58'.

STEINAU, a town of Sileia, and capital of a circle, in the principality of Wohlan, on a small river near the west side of the Oder; containing two churches, and some manufactures of cloth. It has had the misfortune of being sacked and burned in several successive wars; 80 miles W.N.W. of Wohlan. N. lat. 51° 32'. E. long. 16° 24'.

STEINAU, or Szczawa, a town of Silesia, in the principality of Oppeln; 22 miles S.S.W. of Oppeln. N. lat. 50° 18'. E. long. 27° 18'.

STEINAU, a town of Germany, in the county of Hassau-Munzenburg; 16 miles S.W. of Fulda. — Alfo, a town of Germany, in the duchy of Bremen; 24 miles N.E. of Carlburg. — Alfo, a river of Sileia, which runs into the Nyele, opposite to Löwin.

STEINBECH, a town of Germany, in the lordship of Schwarzenberg; 3 miles E. of Schainfeld. — Alfo, a town of Germany, in the county of Henneberg; 5 miles E. of Smalkalden. — Alfo, a town of Austria; 6 miles S. of Steyr. — Alfo, a town of Germany, in the principality of Naflau-Dillenburg; 6 miles N.N.W. of Dillenburg. — Alfo, a town of the duchy of Baden; 5 miles W.S.W. of Gerzschach.

STEINBECH, Langen, a town of the duchy of Baden; 3 miles N.W. of Baden.

STEINBECK, a town of Prussia, in the canton of Stettin; 24 miles S. of Brandenburg.

STEINBERG, a town of Bavaria, in the bishopric of Bamberg; 3 miles N. of Cronach. — Alfo, a town of Weitphalia, in the county of Lippe; 10 miles E.N.E. of Lemgow. — Alfo, a mountain of Welfphalia, in the principality of Calenberg, near Minden. — Alfo, a town of Saxony, in the circle of Erzgebirg; 14 miles S.S.E. of Freyberg. — Alfo, a town of Germany, in the county of Hennep; 3 miles E. of Rombild.

STEINBERGEN. See Steenberg.

STEINBIZA, in Ichthyology, a name given by Hildegard, and some other writers, to that small species of carp, called by others carasius aculeatus, and tenia cornuta. It is the carp with a forked spine under each eye, described by Artedi.

STEINEA, in Geography, a town of Switzerland, belonging to the canton of Zurich, in the Thurgrau; 4 miles N.E. of St. Gall.

STEINFURT, or Burg Steinfurt, a town of Germany, and capital of a county, to which it gives name, on the Rhine; 17 miles N.W. of Munster. N. lat. 54° 15'. E. long. 7° 15'.

STEINFURT, a town of the duchy of Wurzburg; 3 miles W.S.W. of Hasfurt. — Alfo, a county and principality of Germany, surrounded by the bishopric of Munster, about 35 miles in length, and from five to eight in breadth; raised to be a principality of the empire in the year 1495. Part of the territories belonged to the bishop of Munster, and part to the count of Benthem. To a Roman month it contributed 7 florins 32 krueckers, and it was taxed to the imperial chamber 30 rixdollars 44 krueckers.

STEINFURT, or Dernsteinfurt, a town of Germany, in the
the bishopric of Munster; 11 miles S. of Munster. N. lat. 51° 28'. E. long. 8° 31'.

STEINHARD, a town of Germany, in the principality of Anspach; 5 miles S.S.E. of Waffertudingen.

STEINHAUS, a town of the duchy of Sturia; 4 miles N.E. of Muertenzenberg.

STEINHAUSEN, a town of Switzerland, in the canton of Zug, at the north end of the lake of Zug; 2 miles N.W. of Zug.

STEINHEID, a town of Germany, in the principality of Coburg; 9 miles N.N.E. of Coburg.

STEINHEIM, or Ober Steinheim, a town of Germany, in the circle of the Lower Rhine, on the Main; 2 miles S. of Hanau.

STEINHEIM, a town of Westphalia, in the bishopric of Paderborn; 14 miles N.N.E. of Paderborn. N. lat. 51° 47'. E. long. 9° 54'.

STEINHEIM am Mähr, a town of Wurttemberg; 10 miles N. of Stuttgart.

STEINHOF, a town of the Helvetian republic, in the canton of Berne; 16 miles N. of Berne.

STEINHOF, a town of Germany, in the county of Schauenburg, on the south side of the Steinhuder Meer; 13 miles N.W. of Hanover.

STEINHUDER MEER, a lake of Germany, in the county of Schauenburg, six miles long and two broad; 12 miles N.W. of Hanover.

STEINHUN, STONEHEN, in Ornithology, a name given by the Germans to a bird of the lagopus kind, more commonly known by the name of otoa, and in some places by that of colomys.

It seems not to differ from the lagopus in any thing but colour, and that bird being known to change its colour in the summer months, it is probably no other species.

STEINHURST, in Geography, a town of the duchy of Holstein, with a castle; 25 miles E.N.E. of Hamburg.

STEINING, a term used for the lining of stone or bricks to a wall, shaft, or tunnel pit.

STEINISNAK, in Geography, a town of Croatia; 10 miles E.S.E. of Carilid.

STEINKIRCHEN, a town of the duchy of Bremen; 10 miles S.E. of Strande.

STEINORT, a town of Prussia, in Norderney; 52 miles S.E. of Königberg.

STEINPLEISZ, a town of Saxony, in the circle of Erzgebirg; 5 miles W.S.W. of Zwickau.

STEINDORF, a town of Saxony, in the circle of Neustadt; 3 miles S. of Weyda.

STEINSTADT, a town of the duchy of Baden. In October, 1706, the French were defeated here by the Austrians; 16 miles S. of Friburg.

STEISBEL, a mountain of Hungary; 4 miles N. of Kemnis.

STEITZ, a town of Germany, in the principality of Anhalt Zerbst; 6 miles S. of Zerbst.

STEKAN, in Commerce, a liquid measure in Holland. Rhine and Mofel wine, and also spirits distilled from corn, are sold by the am, which contains 4 ankers, 8 rekans, 21 viertels, 64 flours, 128 mingles, 256 pints, or 1024 mussels; and which holds 8956 Dutch, 7705 French, or 9351 English cubic inches, or about 404 English wine gallons. Lined and rape-feed oil is sold in saums of 7½ rekans, or 130 mingles, weighing about 186 lbs. wovindouro.

Train-oil is sold in quarters of 18 or 21 rekans; also in vats of 13 rekans, or 253 mingles. The mingel of 2 pints, or 8 muelles of rain-water, weighs about 2 lbs. 4½ oz. Amsterdam weight: 10 mingels = 6 English wine-gallons, and 27 mingels = 7 English beer-gallons. A vat of oil of olives contains 717 mingels, and weighs 1750 lbs. avoirdupois: 19.83 rekans of Amsterdam = 100 English gallons, and each rekan = 1165 cubic inches.

STEKBOREN, in Geography, a town of Switzerland, in the Thurgau, on the south side of the lake of Zell; 7 miles W. of Constance.

STEKEN. See STEKKEN.

STEKENITZ. See STEKENEK.

STELL, in Ancient Geography, the name of a town in the island of Crete, near Pareaus. Steph. Byz.

STELL, Erota, in Antiquity, a kind of punishment, being a pillar whereon a criminal was exposed, and on which was engraved an account of his crime.

The persons thus exposed to the laughter and reproaches of the people, were called stelis. Potter, Arch. Graec. lib. i. cap. 25. tom. i. p. 130.

STELECHIA, a word used by some authors to express the vena porte.

STELECHITES, in the Materia Medica, a name given by Dioscorides, and some other of the Greek writers, to a peculiarly fine kind of florax. It was the same with the florax calaminus, only that its calamine or catalamine was of a larger, and the name catalamine to the smaller or slenderer pieces. Pliny, Strabo, and many others, join in telling us, that the wood of the florax-tree, on account of its softness and sweet taste, was the most subject to be eaten by worms of that of any tree in the world.

When the worms attacked the body of the tree, the dust they made by their erosis formed a hillock or heap round the tree, or at its foot, and the extravasated balsam running about this dust, made a mafs that was called the cymatium florax at that time, and was the same with the common florax now in use.

STELLERICHEE Stelis Facis, in Natural History, a very uncouth name given by Aldrovandus, and some others, to the entrochi. He gave them this name from the resemblance of some of the longest pieces to fragments of the trunks of trees, the arms parting out from the sides of these main branches, the rudiments of which are very frequent in many of the entrochi, paling for the remains of bougles, and the hollow in the middle, for the cavity where the pith of the plant was. The addition of stelis facis was only from the observing that the top and bottom were radiate to or frigated, from the central hole to the circumference, in the manner of antimony. These are truly no vegetable remains, but parts of the arms of that strange fish called stella arborifera. See Star-Fish.

STELERCHIS, a stirrup, or an instrument used in the baths to rub off the sweat from the skin.

STELENDA, in Ancient Geography, a country of Asia, in Syria, near the delents of Palmyra. Pliny.

STELHAVEN, in Geography, a town of Holland; 3 miles S.W. of Gertrudenburg.


Gen. Ch. reformed. Cal. Perishath of three equal, ovate, keeled, somewhat concave leaves, cohering at the base. Car. Petals two, distinct, much smaller than the calyx, oblong, concave, vaulted over the columns. Nectary a lip without any spur, of the same, and nearly the shape, of the petals, somewhat emarginate, inflexed at the edge. Stem. Anther a vertical moveable deciduous lid, of two cells; masses of pollen globular, at length waxy, solitary. Pjst. German inferior,
STELIS.

inferior, ovate; style very short, dilated, hollowed, with three teeth, at the summit; stigmas in front, near the anther, convex. Peric. Capsule oval, with three angles and three furrows, one cell and three valves; the uppermost furrow keeled.


Section 1. Inflorescence terminal.

1. S. ophiodon. Adder's-tongue Stelis. Swartz Ind. Oec. 1551. Willd. n. 1. Ait. n. 1. (Epidendrum ophioglossiodes; Linn. Sp. Pl. 1553. Jacq. Amer. 225. t. 133. f. 21; extr. Smaller's synonymy. E. trigonorrhizum; Swartz Prodr. 125.)—Stem with a solitary, oblong-lanceolate leaf, about the length of the spike. Cloised flowers three-flowered.—This grows on the stems and branches of trees, in the mountainous woods of Jamaica, and other islands of the West Indies, flowering in July and August. The pinnate root consists of numerous long, simple, zigzag, whitish fibres. Stems several, two or three inches high, simple, clothed with compresse, oblique, tubular, membranous sheaths, and bearing at the top one coriaceous, ribbed, blunth, nearly elliptical leaf, two or three inches long, on a short twisted footstalk. Spike generally solitary, axillary, stalked, erect, slender, simple, rather taller than the leaf, bearing numerous, alternate, small, ovate, acute bracteas. Flowers very minute, nearly or quite ellow, flat at the base, when closed perfectly triangular. Calyx pale green. Petals light red. Lip dark purple. Anther purple.

2. S. micrantha. Small-flowered Stelis. Swartz Ind. Oec. 1553. Willd. n. 2. Ait. n. 2. Sm. Exot. Bot. t. 28. 31. t. 75. (Epidendrum micranthum; Swartz Prodr. 125.)—Stem with a solitary, lanceolate leaf, shorter than the spike. Cloised flowers fix-flowered.—Found on trees, and at the sides of rocks, on the lofty mountains of Jamaica. Swartz. The marquis of Blandford received it from thence in 1805, and it flowered in his lordship's flower in November 1806. This has the habit of the preceding, but is rather larger, with a longer, stronger, narrower, leaf. The flowers are numerous, revolved in their position, but we know not whether this character is proper to the whole genus. When closed, they form a roundish fix-flowered figure. Calyx green. Petals and lip, as well as the column and anther, of a dark brownish-purple.

3. S. acutifolia. Sharp-flowered Stelis. Willd. n. 3.—

4. S. lanceolata. Lanceolate Stelis. Willd. n. 4.—

5. S. polyrhachis. Many-spiked Stelis. Willd. n. 5.—

6. S. obliqua. Long-leaved Stelis. Willd. n. 6.—


8. S. revoluta. Revolute Stelis. Willd. n. 8.—

9. S. cordata. Heart-shaped Stelis. Willd. n. 9.—

10. S. racemosa. Yellow Racemose Stelis.—Leaf lanceolate, emarginate, on a short footstalk. Clusters radical, nearly sessile, deflexed.—Found by Dr. F. Buchanan, on trees in Upper Nepal. The root is thread-shaped, creeping, fixating itself at intervals by means of tufts of numerous fibres, from the crown proceeds a green ovate bulb, an inch long, bearing an erect leaf, measuring, with its short footstalk, four or five inches. Clusters solitary from the bases of some of the bulbs, each four inches long, pendulous, on a short footstalk, enveloped in membranous sheaths. Flowers about ten, rather ditant, revolved, each on a very short partial footstalk, accompanied by a lanceolate membranous bracteas equal to the germin, or longer. Calyx-leaves yellowish-green, about half an inch long, equal, lanceolate, erect; one of them gibbous at the base. Petals very short, obtuse, of the same hue. Lip short, ovate, thick, entire, revolute.

11. S. hirta. Hairy-flowered Stelis.—Leaf ... Spike radical, cylindrical, on a long footstalk, drooping. Calyx hairy. Gathered by Dr. Buchanan, on mossy rocks in Upper Nepal, flowering in January. The inhabitants call it Sunipia, whence Dr. Buchanan named all the species of this section Sunipia, as composing a new genus. The difference of their habits from the original Stelises countenances this measure, but we are not distinctly enough acquainted with the precise structure of their flowers, to deduce a character from thence. The species before us has a creeping root, with crowded owate bulbs. Of its leaves nothing is known. The flower-stalks are solitary, from the base of each bulb, erect, a span high, with a few scattered sheaths; and each bears a dense drooping spike, nearly its own length, of very numerous, viscid, highly fragrant, crowded flowers, of the size and shape of the last, but remarkable for their calyx being all over finely hairy on both sides.

12. S. odoratissima. Capitate Fragrant Stelis.—Leaves elliptical, obtuse, sessile. Flowers capitate. Native of mossy rocks, in Upper Nepal. Buchanan. The root creeps, bearing diffusor oblong bulbs, on each of which stands a feathery leaf, nearly two inches in length, and somewhat emarginate. Flower-flasks erect, from the base of each bulb, and as tall as the leaf, each bearing a round drooping head of several white highly fragrant flowers, the points of the calyx yellow.

13. S. biflora. Two-flowered Stelis.—Leaves ovate, obtuse, on long footstalks. Bulbs nearly globose. Stalks about two-flowered.—On the mossy rocks of Upper Nepal. Buchanan. The branching creeping roots bear scattered globular bulbs, not an inch in diameter. The footstalk of each leaf is an inch and a half long, erect. Leaf two inches, or more. Flower-flasks a little remote from each bulb, hardly as long as the leaf, bearing usually two yellow flowers, larger than any of the foregoing; their petals an inch long, gradually swelling upwards. Petals pointed, much smaller than the ovate calyx-leaves. Lip ovate, revolute, entire, stalked, as long as the calyx.

We find among Dr. Buchanan's drawings and descriptions several more species, referred to his genus Sunipia, whose habit agrees exactly with our four last described. The parts of the flower however appear more unequal, or irregular, than properly belongs to Stelis, as is somewhat the case with our biflora. We leave them therefore, having no
specimens, to the future illustration, as we hope, of their ingenious and accurate discoverer.

STELITÆ, Στήλης, in Antiquity. See STELE.

STELLA, Jacques, in Biography, an eminent French painter, was born at Lyons in 1596. He was the son of an artist of that name, originally of Flanders, but who had settled at Lyons on his return from Italy. His father taught him the rudiments of design, but he was deprived of his instructor when only nine years old. He had however already imbibed sufficient taste to proceed by himself, without the help of another master. In his twentieth year he travelled to Italy, intending to proceed to Rome to finish his studies; but was stayed in his progress at Florence, by Cosimo de Medici, to assist in the decorations preparing for the marriage of his son Ferdinand. The grand duke retained him in his service, and gave him a pension, with apartments, and he remained there seven years. At the end of that time he continued his intended journey, and at Rome he studied with unremitting attention the works of Raphael, in company with Nicolo Poussin, with whom he lived in intimacy and friendship.

He had received repeated invitations from the court of Spain, and set out from Italy with an intention of going there, but was again interrupted in his journeys by the solicitations of cardinal Richelieu, who recommended him to Louis XIV., and procured him a pension of a thousand livres, together with the employment of flaman painter, and an apartment in the Louvre; and, besides all these advantages, the order of St. Michael was conferred upon him, as a particular mark of the king’s favour.

Stella had considerable genius, but wanted a pure taste; his knowledge of Raphael and the Italian schools had not given that bleffed odour to his works. His invention was ready, and his execution agreeable; the attitudes of his figures, however, exhibit the study and the lamp; and nature is less frequently the guide of their expressions than art. His colouring is completely artificial; and yet with these defects, there is an agreeable air in their effect; the parts are well balanced, and life and activity reign in them. He was most successful in his smaller productions. He died at Paris in 1647, aged 51.

STELLA, Francis, was the younger brother of Jacques, and born in 1601. Though he lived very much with his brother, he never arrived at much eminence. There are many of his pictures in the churches in Paris.

STELLA, Giuseppe Maria, an Italian ecclesiastic, author of a treatise entitled Alli Grandi, per imparare con ogni facilità l’It. Fermo I°; or short rules for young students to learn with the utmost facility canto fermo, divided into two parts. In Roma, 1665, 4to.

This is an elaborate treatise on the subject, probably intended for the instruction of young persons intended for holy orders in the Romish church. The notes are taught by the Guidonian hand. The clefs and hexachords are explained in a clear manner, and the service of the whole year is given in Gregorian notes, on four lines only.

STELLA, the name of a bandage in Surgery, resembling a bandage, the numerous offerings which it makes. It is employed after arteriotomy in the temple.

STELLA. See PSEUDOSTELLA.

STELLA CRiminis, in Natural History, a name given by Linkius to a genus of star-fish, the characters of which are these: that they have more than five rays, and from these have several other lateral processes, which are covered with a fine down or hair.

STELLA, in the Materia Medica, the name of a floss which has been very differently interpreted by different writers. Some have supposed it the ateria of Pliny, and some the common corallloid alkorites; but Meufele explains it to be the lapis lazuli.

STELLA, in Natural History. See STAR-FISH.

STELLA, Aropeciunt. See BASKET-FISH, and STAR-FISH.

STELLA Occidens, a word used by some of the chemical writers to express fial ammoniac.

STELLA Schelendrenica, a name given by Linkius to a kind of star-fish with an undivided body, and five rays, resembling the bodies of the scolopendra, as those of the more usual kind, called fella lumbrieralia, do the bodies of common earth-worms.

STELLA Vermiformis, a name given by Linkius, and other authors, to a common kind of star-fish, which has five rays parting from the body, each somewhat resembling the body of a large worm.

STELLA, in Geography, a river of Friuli, which runs into the gulf of Venice, 4 miles S.S.E. of Prienissa.—Alfo, a small island of Italy, in the lake of Garda; 14 miles N.W. of Verona.—Alfo, a mountain of Naples, in Principato Citra, on the coast, near Cape Licoja.—Alfo, a town of Italy; 12 miles N. of Friuli.—Alfo, a mountain of the Grifons; 15 miles S.W. of Tufa.

STELLA, La, a town of Naples, in Principato Citra; 27 miles S.W. of Cassigiano.

STELLAR. See INTER-STERLAR.


STELLARIA.

decisive mark, under its numerous varieties, it may be known at once from every plant of its natural order, except S. cerafoioides; but particularly from Cerastium aquaticum. Leaves opposite, ovate, entire, smooth, on fringed flalks. Flowers white, inconspicuous, on foliar, axillary, or terminal flalks, which are hairy on one side.

"It is a good vegetable boiled like Spinach. Small birds eat the whole herb, as do young poultry."

3. S. dichotoma. Forked Stitchwort. Linn. Sp. Pl. 603. Sm. Pl. Ic. t. 145—Leaves ovate, sessile. Stem forked. Flowers foliar. Stalks when bearing fruit reflexed. —Native of Siberia, whence it was sent by Gmelin to Linnaeus. It flowers in July. Root annual. Stem round, downy, much branched, and spreading on all sides, remarkably forked, leafy, many-flowered. Leaves two at each division of the stem, opposite, acute, sessile, downy. Flowers foliar, on round, downy flalks, which are upright at first, but bent back, as if broken, when the fruit is ripened.

4. S. radicans. Radiated Stitchwort. Linn. Sp. Pl. 603. Wildl. n. 3. (Alline faxatilis, angulato et oblongo falcis folio, flore albo, tenuissimi lacinante; Amm. Ruth. 64. t. 10.)—Leaves lanceolate, with small ferratures. Petals deeply five-cleft. —Native of Siberia, in swampy ground. Root slender, yellowish, jointed. Stems at the radical joints, about a span high, slender, upright. Leaves opposite, pale green, hairy, veined, like those of a willow. Flowers terminal, solitary, white, on slender flalks, with much-divided or jagged petals, in which respect it differs from all the other species.


"This herb has so much of a grassy appearance, that old botanists have named it the white-flowering grass."

7. S. graminea. Leaffer Stitchwort. Linn. Sp. Pl. 604. Engl. Bot. t. 803.—Leaves linear-lanceolate, entire. Panicule terminal, spreading. Calyx three-nerved, about equal to the petals. —Common among furze-bushes, heath, and low broom, on a gravelly or sandy soil, principally observable in the early summer months. Root perennial, creeping. Stems and flower-flalks perfectly smooth. Leaves entire, scarcely ever rough at the margin. Flowers in a divaricate panicule, extremely elegant, white, bepansing furze-bushes and other shrubs, which so conceal the herbage as to make the flowers seem suspended in the air. The calyx-leaves are remarkable for having three, acute, green ribs. The whole habit of this greatly resembles that of the last species, but its size is smaller, and the colour a grafs-green, not glaucous.

8. S. glauca. Glaucous Marsh Stitchwort. Sm. Pl. Brit. 475. Engl. Bot. t. 825. (S. paludis; Wildl. n. 7.)—Leaves linear-lanceolate, entire, glaucous. Flower-flalks erect. Calyx three-nerved, shorter than the petals. —Found occasionally in a moitl, gravelly soil, on meadows or in ditches, in many parts of Great Britain, flowering from June to August. Very nearly allied to the preceding species in form, but perfectly distinct. Its glaucous colour, perfect smoothness of the edges of the leaves as well as of the stem, and larger flowers, the petals being twice as long as the calyx; to which may be added that the flower-flalks are more universally lateral and foliar, much less collected into a panicule, and the three nerves of the calyx less sharply prominent; all these circumstances help to distinguish it from the former. In colour, size, and general habit, it rather approaches the S. bolsoidea, but that is beautifully distinguished by the total want of nerves in its calyx, and the rough edges of its leaves and flalks."

9. S. vulgaris. Bog Stitchwort. Sm. Pl. Brit. 476. Engl. Bot. t. 1074. Curt. Lond. facs. 6. t. 28. (S. Alwe; Wildl. n. 9.)—Leaves elliptic-lanceolate, entire, with a callous tip. Flowers irregularly panicked, lateral. Petals shorter than the calyx. —Frequent in rivulets, and clear brooks or ditches by road-sides, flowering plentifully in June. Root annual, fibrous, small. Stems numerous, feebly, branched, square, smooth, leafy. Leaves much veined, pale, glaucous, a little undulated at the margins, with a callous tip. Flowers very small, yellowish, on axillary and terminal flalks, generally three in number, two of which are three-cleft and three-flowered, the remaining one single-flowered, all furnished with membranaceous, lanceolate bracteas. This species, like S. cerafoioides, is remarkable for varying in the number of its stamens, from three to five.

10. S. cacipera. Many-flaked Stitchwort. Wildl. n. 17. Engl. Bot. t. 1259.—Stem shorter than the flower-flalks. Leaves linear-lanceolate, rough-edged. Calyx three-nerved, the length of the petals. —Native of Scotland, where it was discovered by Mr. G. Don in 1794. Root perennial. Stems very short, (Wilkewow incorrectly says, none,) tufted, thickly clothed with numerous, opposite, acute leaves, smooth except at the edges, turning red in decay, each having a fingle rib, very thick at the base, tapering and vanishing towards the point. Flowers terminal, white, on long, moity single flalks.


three or four inches long. Leaves opposite, sessile. Flowers axillary and terminal, two or three together, on capillary, long-stalked stalks.


16. S. biflora. Two-flowered Stitchwort. Linn. Sp. Pl. 604. "Swartz in Stockh. Tran. 1788. t. 4. f. 1."—Sagina ramis erecitis bifloris; Fl. Lapp. ed. Sm. 126.—Leaves awl-shaped. Branches divided. Petals emarginate. Calyx fringed.—Native of the Lapland Alps, and of North America. The habit of this species greatly resembles that of either a Sagina or Arenaria. Stems scarcely three inches long, thread-shaped, almost naked. Leaves radical, tufted. Flower-stalks two together, at the divisions of the stem, each bearing a delicate, white, very small flower, with slightly emarginate petals; the figure in Fl. Dan. t. 13. appears to be incorrectly quoted by authors for the present species.

17. S. groenlandica. Greenland Stitchwort. Wildl. n. 15. Retz. Prod. Fl. Scand. 192.—Stems decumbent, generally two-flowered. Leaves linear, slightly fringed at the base. Petals emarginate. Fruit globose.—Native of Greenland. This delicate little herb is scarcely more than an inch in height, with very slender stems. Leaves a little flabby, and fringed at the margin with long hairs. Flowers white, large in proportion to the plant, with scarcely emarginate petals.

18. S. Arenaria. Sandwort Stitchwort. Linn. Sp. Pl. 604. Wildl. n. 16.—Leaves spatulate. Stem erect, bifid. Branches alternate. Petals emarginate.—Native of Spain. Root annual, fibrous. Stem erect, round, a span high, downy and rather glabrous, with spreading hairs. Branches alternate, nearly as long as the stem. Leaves sessile, smooth above, hairy at the margin, and beneath. Flowers white, large, one at the division of the branches, the rest alternately from their axils.

19. S. pilosa. Woolly Stitchwort. Michaux Borel. Amer. v. 1. 273. Pursh v. 1. 217.—Leaves sessile, ovate, fringed. Flower-stalks erect. Petals longer than the calyx.—Native of shady woods on a rich soil from Pennsylvania to Carolina, flowering in May. All that we know of this species is from the above quoted authors, the former of whom observes that the whole herb is remarkable for being clothed with a downy woolenline. The flowers are large and white. Calyx leaves oval.

Stellaria is also a name used by some authors for the common chickweed. See CARYOPHYLLACEAE.

Stellaria is also a name given by many authors to the various species of arthrotes, or star-fish. See STAR-STONE.

STELLATA, in Geography, a town of Italy, in the department of the Lower Po; 12 miles N.W. of Ferrara.

STELLATE PLANTS, such as have their leaves growing on the stalks, at certain distances, in the form of a star with rays; or such flowers as are star-like, or full of eyes resembling stars.

Mr. Ray makes the stellate plants, so called from the disposition of their leaves, the tenth genus of English plants; of which kind are croft-wort, mollugo, wild madder, aseprula or woodruff, gallium, or ladies bed-straw, sparine or cleavers, and rubia tinctorum or dyers' madder.

STELLENBOSCH, in Geography, a small town of South Africa, near the Cape of Good Hopes. It consists of three long, straight streets, running parallel to each other, and several cross streets intercepting these at right angles. The houses are all spacious, and substantially built, though only thatched with straw. Each street resembles an avenue, since, on both sides before the houses, are large shady oaks, which are almost as old as the place itself, which was built at the beginning of the former century, though it was wholly burnt down in 1710. In December, 1803, a similar accident happened, when the number of houses left standing was about 60. The church was built in 1728, and though not equal in size to the churches of Roodezand and Paarl, it is no way inferior to them in point of architecture. The number of inhabitants at Stellenbosch, including slaves and Hottentots, is estimated at 1000. Every person in this town carries on, with his trade, some portion of agriculture and horticulture; and as there are none who can be called actually poor, who labour for hire, they are obliged to have slaves, who do not pay the expense of keeping them.

Strangers, who in their long voyages make any stay at the Cape, never fail to visit Stellenbosch; and people of property at the Cape Town also, in the fine season of the year, often make parties of pleasure to this fertile spot. Hence houses are fitted up here for the accommodation and entertainment of strangers.

STELLENBOSCH. See DRAKENSTEIN.

STELLENBOSCH, Drostdy of, one of the divisions of the Stellenbosch district, is a very handsome village, consisting of about seventy habitations, to most of which are attached offices, out-houses, and gardens, so that it occupies a very considerable space of ground. It is laid out into several large or open spaces, and particularly at the back, which have here attained a greater growth than in any other part of the colony. This village, which is the residence of the drostdy, is delightfully situated at the feet of lofty mountains, on the banks of the Eerste, or First river, at the distance of twenty-six miles from Cape Town. In it is a small neat church, which is annexed a parsonage-house, with a good garden, and very extensive vineyard. The clergyman has a salary from government of 150£ a-year, with this house, garden, and vineyard, free of all rent and taxes, in lieu of other emoluments received by the clergy of Cape Town. A popular clergyman is loaded with presents from day to day. Game of all kinds, fat lambs, fruit, wine, and other good things, are pouring in upon him occasionally. His outgoings are chiefly confined to the expense of clothing his family, and a little tea and sugar. The drostdy has a salary and emoluments that seldom fall short of 150£ a-year; an excellent house, in a pleasant situation; and an extensive garden, orchard, and vineyard. The grounds in or near the village are mostly such as they call eigendoms, or freeholds, though they are held by a small recognizance to government; but they are totally different from loan-farms, which are the usual kind of tenure in the colony. There are eight other small divisions, besides this drostdy, which surround it, and lie between it and Fallof bay. They consist chiefly of freehold ewes, and produce wine, brandy, fruit, fresh butter, poultry, and a variety of articles for the Cape market, and for the supply of ships whilst they continue
continue in Simon’s-bay. They yield also a small quantity of corn. Barrow’s Africa, vol. ii.


St. S. Paffriss has eight Ramens, S. Chamaejasme ten. Linnens and other authors inaccurately define the calyx as a corolla. Ed. Ch. Calyx mostly four-cleft. Corolla none. Stam. very short. Nut foliary, beaked.

1. S. Paffriss. Flax-leaved Stelleria. Linn. Sp. Pl. 512. Jacc. 1c. Rar. v. 1. t. 68.—Leaves linear. Flowers axillary, sessile, with a four-cleft calyx.—Native of dry, sandy fields, in Germany, Switzerland, France, and Italy, flowering in July and August. In general appearance, this herb resembles Thyrsus alpinus. It is acrid, bitter, and purgative. ""Red, angular, spindle-shaped, nearly simple, yellow on the outside, white within. Stem upright, about fix inches in height, much branched from the very bottom. Leaves alternate, sessile, acute, entire, smooth, spreading, reflexed, shaped like a sparrow’s tongue, whence Linnens adopted its old generic name as a specific one. The stem and branches are terminated by long, loose, interrupted, leafy spikes. Flowers sessile, three, four, or five together, at the axils of the leaves, imbedded in wool at the base, greenish, with yellow tips.

St. Chamaejasme. Siberian Stelleria. Linn. Sp. Pl. 515. Gmel. Sib. v. 3. 37. (Chamaejasme radice Mandragora; Amman. Ruth. 16. 2.)—Leaves lanceolate. Flowers terminal, clustered, naked, with a five-cleft calyx.—Native of Siberia, on the banks of rivers; flowering in June. Root externally brown, internally white, having a sweetish taste, and in its mode of growth greatly resembling the Mandrake root, divided generally into two parts, each furnished with numerous radicles. Siumi numeros, slender, weak, reddish below, pale green at the summit. Leaves alternate, short, acute at each end, nerved. Flowers white and purple, five-cleft.

STELLI0, in Zoology, the name by which authors call the swift or spotted lizard. The spots which distinguish this kind are not, however, reticulated, as might be supposed from the name, but round: some small, and scattered irregularly all over the body; and others larger, and disposed in thirteen zones or semicircles. The spots are much more distinct and clear on the back than on the belly. It is common in Syria, and some other places. See EFT and Lizard.

The flax, named by the Greeks coccodrilo, is the most common species of lizard in all the islands of the Archipelago, in Crete, in the Morea, on the coast of Naxos, in Egypt, and in Syria. Olivier describes it as having the body mixed with green, yellowish, and brown; the head and the back covered with scales, simple or tubercled, and pointed. The scales of the feet are more turned up, and more pointed, than those of the back. The tail is verticillated, and covered with prickly scales. This lizard acquires ten or twelve inches in length. It lives on insects, and does no mischief. It seeks the sun in summer; in winter it keeps in holes, and there pusses that feaion in a kind of torpor.

STELLI0 Adelfa, an affected term used by some chemical writers for cinnamon.

STELLIONATE, Stellionatus, in the Civil Law, a kind of crime committed by a fraudulent bargain, where one of the parties sells a thing for what it is not. 

When fairs, the word comes from latine, a very subtle kind of lizard. We find mention of it in the Code, leg. 1. tit. 54, as, if I sell an eftate for my own, which belongs to another; or convey a thing as free and clear, which is already engaged to another; or put off copper for gold, &c.

The Romans frequently used stellinatus to express all kinds of crimes that had no proper names.

STELLITES, in Natural History, a name given by some writers on fossils to a kind of white stone found on mount Libanus, and in some other parts of Syria, containing the lineaments of the fish-scalps. The same names frequently contain the lineaments of other fishes.

STELLOW, in Geography, a town of the duchy of Holstein; 9 miles N.N.E. of Elmenhorn.

STELLOCHITES, a name given to oceocolla.

STEM, in Botany, that part of a plant arising out of the root, and which sustains the leaves, flowers, and fruits.

In trees, the stem is called the trunk, or stock; in Latin saxalis, and truncum.

In herbs, it is ordinarily called the stalk; by the Latins caulis; and stipeus, when flattened like a column.

In the several kinds of corn, and plants of that kind, it is more properly called culmus.

The stem of the plant, according to Dr. Grew, is no more than the cuticle, or skin, which at first covers the two lobes, and the plume of the seed, and which is further dilated as the plant grows.

The stems of shrubs and trees are, for the most part, a great deal larger, and more woody, firm, and solid, than those of the herbs. See Stalk.

They are of the stems of forest and some other sorts of trees, which principally form and constitute, as well as afford, the timber which is employed for different rural uses; and which may be made to serve different purposes and intentions, by the different modes of training and managing them. See Timber.

In gardening, the stems of fruit-trees and fruit-shrubs are trained and managed in a great many different ways and manners, so as to suit different uses and intentions in this sort of culture and practice. They have also lately, for serving particular purposes and designs, been found capable of being so trained, where the trees are to be planted on the contrary sides of the walls to those on which they are to run and be wrought, as to be introduced through holes, made in a slanting upward direction from the bottom parts of them, to the sides of about five inches in diameter, and the name of number of inches in height from the surface of the borders, with great success and benefit. See Standard-Tree and Wall-Tree.

The stems of many low plants and trees are likewise sometimes trained with different kinds of ornamental heads, and other parts, for a great variety of different uses and purposes, as pleasure-ground planting. See Planting.
The term "item" is also occasionally, in some dicotyledons, made use of to signify the handle of any sort of tool of the folk kind.

**Stems of Ships.** A circular piece of timber, into which her two sides are united at the fore-end; the lower end of it is scarfed to the keel, and the bowprit rests upon its upper end.

The item is formed of one or two pieces, according to the faze of the vessel; and as it terminates the ship forward, the ends of the wales and planks of the sides and bottom are let into a groove or channel, in the middle of its surface, from the top to the bottom; which operation is usually called rabbotting.

The outside of the item is usually marked with a scale, or division of feet, according to its perpendicular height from the keel; the intention of which is to ascertain the draught of water at the fore-part, when the ship is in preparation for a sea-voyage, &c.

The item, at its lower end, is of equal breadth and thickness with the keel, but it grows proportionately broader and thicker towards its upper extremity. Falconer. See SHIP-BUILDING.

**Stems, Fauxs, that fixed before the right one.** When a ship's item is too flat, so that she cannot keep a wind well, they put a false item above, which makes her ride more way, and bear a better sail.

**STEMMATTA, in the History of Insects,** are three smooth hemispheric dots, placed generally on the top of the head; as in most of the hymenoptera, and other classses. The name was first introduced by Linneaus. See ENTOMOLOGY.


**Gen. Ch. Cal. Perianth inferior, of one leaf, five-cleft, erose, equal, permanent. Cor. of one petal, irregular. Tube the length of the calyx. Limb two-lipped, almost upright; upper lip ovate, undivided; lower lip divided into three, rounded, equal segments. Stem. Filaments four, nearly equal, as long as the tube, all cloven; anthers eight, one placed on each division of the filament. Pfl. Germen superior, rather obtuse; style simple, the length of the filaments; stigma somewhat blunt. Peric. Capsule oblong, ovate, of two cells and two valves of a contrary partition. Seeds numerous, globose. Recaptae nearly cylindrical.

**Eff. Ch. Calyx five-cleft. Corolla two-lipped. Filaments cloven, each furnished with two anthers. Capsules two-celled.**

1. **S. maritima.** Sea Stemodia. Linn. Sp. Pl. 881. Swartz Obs. 242. (Scordium maritimum, fruticosum procumbens; Siamen Hift. Jam. v. 1. t. 110. f. 2.) —Leaves opposite, half clasping the stem. Flowers few, solitary. —Native of the southern parts of Jamaica, on the sea-shore. Root, probably biennial, long, round, fibrous. Stem from one to three feet high, hairy, erect, or occasionally scarce, much branched. Leaves small, few, ovate-elliptical, obtusa, serrate, thickish, hairy, with smaller ones at the sides of the larger. Flowers few, axillary, among the terminal leaves. Small, white or blue.

The whole herb has a plesant aromatic smell, with a bitterish taste.

2. **S. durantaefila.** Marsh Stemodia. Wild. n. 2. Swartz Obs. 240. (Capraria durantaefila; Linn. Sp. Pl. 876. Veronica caule hexanguli, folia faturee terius, serrata; Sleume Hill. Jam. v. 1. t. 134. f. 2.) —Leaves three in a whorl, combined. Flowers two or three together, nearly sessile. —Native of Jamaica, in marshes on the shore, in clay. Stem herbaceous, a foot high, erect, branched, leafy, angular at the base, roundish upwards, hairy, clummy. Leaves sessile, toothed or rather serrated, spreading, nervcd, downy. Flowers on such short stalks as to be all but sessile, small, of a blue colour.

3. **S. villosa.** Vidic Stemodia. Mart. Mill. Dict. n. 3. Roxb. Coromandel. v. 2. 153. t. 165. —Leaves opposite, clasping the stem. Flowers on stalks, solitary. —Native of Coromandel, in rice-fields after the crop has been cut. The Telingas call it Buda-forum. —Stem herbaceous, two feet high, generally inclining to one side, branched from the base, square, hairy. Leaves linear, serrated, clummy like the whole herb. Flowers axillary, small, violet-coloured. The plant has a pleasant aromatic smell.


Vahl mentions a variety of **S. camphorata**, with narrower leaves, which, he says, may probably be **Dedarias orientalis**.

6. **S. aquatica.** Water Stemodia. Wild. n. 5. —Leaves three together; those immersed doubly pinnae, pinnae; those above water undivided, lanceolate, sessile. Spikes axillary. A native aquatic of the East Indies, found near Tranquebar. —Stem from six inches to two feet in height. Flowers few; doubly pinnate; three-nerved, smooth, deeply serrated from the middle to the tip. Flowers alternate, sessile, in terminal spikes. —S. parviflora. Small-flowered Stemodia. Ait. n. 1. ("Eruis verticillatus; Mill. Dict. ed. 8."") —Stem prostrate, much branched, downy. Leaves three together, on stalks, ovate, crenate. —Native of South America, flowering in July and August. First cultivated by Mr. Philip Miller in 1759. We know nothing further of this species than what is here extracted from the Hortus Kewensis.

**STEMOCHA,** was so denominated by Loureiro, from **stemma, a stem,** because of the remarkable form and connection of those organs in its flower; which latter circumstance led him to refer the genus to the class Monandria. His genus, however, proved by the description, and indeed by the synonym of Rumphius, to be no other than our's and Mr. Dryander's *Roxburghia*; see that article. We had not made this discovery when the said article was written. What would those who fickle for the mere right of priority of names, in spite of authority, sense, utility, or taste, do in this case? Stemona is by far the oldest name, liable to little or no exception, and given by an able and learned botanist. Yet surely every one would retain Roxburghia, for the sake of its author's authority. We cannot but contest for the occasional exercise of some discreditable power, when obviously for the good of science; however averse we may always be to alterations of established and received names, though perhaps for the better.
STEMPHYLITE, a name given to the ancients to express the stalks of grapes, or the remains of the pressings of wine. The same word is also used by some to express the remaining mass of the olives, after the oil is pressed out.

STEMPHYLLITES, a name given by the ancients to a root of wine pressed hard from the hulks.

STEMPLES, in Mining, crofts bars of wood in the shafts, which are sunk to mines.

In many places the way is to sink a perpendicular hole, or shaft, and hew sides of which they strengthen, from top to bottom with wood-work, to prevent the earth from falling in: the transverse pieces of wood, used for this purpose, they call stemples, and by means of these the miners in some places defend, without using any rope, catching hold of them with their hands and feet.

STEMSON, in Ship-Building, a piece of compacts timber, wrought on the outside of the apron, the lower end of which scars into the keel. Its upper end is continued high enough to tenon into the under side of the middle or upper deck hook, in the thickness of the stem. In five short, spreading, lanceolate, blattish segments, bearded underneath at the extremity, as well as half way along the dish from the base. Nectary a cup-shaped undivided gland surrounding the base of the germen. Stem, Filaments five, inserted into the tube, and enclosed within it, thick and fleshy, broader than the anthers, which are linear, in the mouth of the tube. Pjft. Germen superior, roundish, of five cells; fyle capillary, the length of the tube; stigma simple, obtuse. Peric. Drupa nearly dry, globose. Seed. Nut of three or more cells, with a thick, not very hard, shell, not bursting, with a pendulous kernel in each cell.

Eff. Ch. Outer calyx of many imbricated leaves. Corolla tubular; its tube swelling, twice as long as the calyx, naked within; limb much shorter, spreading, bearded half way. Filaments included in the tube, fleshy, broader than their anthers. Drupa almost dry, of three to five cells.

1. S. pinifolia. Pine-leaved Stenantha. Br. n. 1. — Native of the neighbourhood of Port Jackson, New South Wales, from whence we have a specimen gathered by Dr. White, but this shrub has not yet found its way into the gardens of England. It is the only known species of its genus. The stem is woody, erect, spreading, branched, scarred; the younger branches hairy, clothed with innumerable, crowded, awl-shaped, pungent, revolute, roughish, fleshy leaves, about an inch long. Flowers axillary, erect, fleshy, about the base of each branch, very beautiful, with a rich scarlet tube an inch long, and a yellowish-green limb, making a singular, but most agreeable, contrariety. Drupa the size of a small pea, invested with the brown chaffy calyx.

STÉNAY, in Geography, a town of France, in the department of the Meuse, and chief place of a canton, in the district of Moultmèdy; 21 miles N.N.W. of Verdun. The place contains 3599, and the canton 14,434 inhabitants, Vol. XXXIV.

STE, on a territory of 170 kilometres, in 18 communes. N. lat. 49° 30'. E. long. 5° 16'.

STENBOCK, MAGNUS, in Biography, a distinguished Swedish general, son of Gustavus Otto Stenbock, a general under Charles XI. and XI., was born at Stockholm in 1664. He was educated at Upsal, and in 1683 he set out on his travels, and having entered into the Dutch army, he served several campaigns with the allied forces in the Netherlands, and on the Rhine, under the princes of Wal- dec and Baden. He distinguished himself so much by his bravery and good conduct, that he was, in 1697, appointed to be colonel of a German regiment, then in the garrison at Wismar, where he employed his leisure time in composing a work on the art of war, entitled "The Swedish Military School," which, however, he did not find leiture or inclination to publish. He accompanied Charles XII. in almost all his expeditions, and contributed by his skill and exertions to the victory obtained at Narva. In the Polish campaign, till 1706, he sometimes accompanied the king and the main army, and sometimes was entrained with the command of detached bodies employed chiefly in levying contributions; a service for which he was unusually well qualified; he was also employed in constructing bridges over such rivers as the Swedish army had to pass, on its incursions into Poland, and on its return from that country. In the year 1706 he attended the king to Saxony, where he was appointed governor of Scania. When he arrived there, he found every thing in the utmost confusion; the most shameless abuses had been committed; and in order to put an end to them, and deter others from similar practices, he put the laws into most severe execution; but a war breaking out put a stop to his plan of reform. When intelligence of the Swedes being defeated at Parnawa by Frederic IV. of Denmark, he made preparations for the invasion of Scania. Stenbock was appointed to oppose him; he put himself at the head of 8000 old troops and 12,000 new levies, and went in pursuit of the Danske, who were committing incredible ravages in the country. There was no time to clothe the newly raised troops in military array; of whom the greater part was drenched in frocks, and had piloths tied to their girdles with cords. They attacked the enemy; and what was wanting in order and discipline, was amply compensated for by the untrained raw troops completely defeated the regular army of the king of Denmark. The Danses quitted Sweden with great precipitation, having first killed their horses, and destitute by fire their baggage and magazines. They left behind them about 4000 wounded soldiers, of whom the greater part died, as well by the infection from the dead horses, as by the want of food, of which they had been deprived by their own countrymen. After Scania had been freed from the ravages of the enemy, Stenbock's first care was to strengthen the fortifications of Christiansbad, being a place of great importance, for the defence of that part of Sweden. The activity which he displayed on this occasion, induced Charles, the year following, to entrust him with the direction of another enterprise, the successful and speedy execution of which great importance was attached. This was to repair, as speedily as possible, with several regiments to join the troops in that province and to proceed afterwards, under the command of Stanislaus, to meet his Sweedish majesty, on his proposed return from Turkey. In this measure he was thwarted by the senate, and he experienced many difficulties which he did not anticipate; of these, one was the want of money. He, however, went to Stockholm, and exerted himself to successfully, that he collected, in the course of a month,
more than $300,000 rix-dollars, and fitted out some vessels for his intended expedition. In the course of his voyage he fell in with the Danish fleet, by which he was attacked, and more than thirty of the Swedish ships were lost. In consequence of this unfortunate event, Stenbock drew up a paper in vindication of his own conduct. After this he took Roftock; and having received a considerable reinforcement of troops, gained a memorable victory, in 1712, over the Danish and Saxon forces: he then proceeded to the army in Holstein, and having burnt Altona, was, in the month of May, 1713, hemmed in at Tooningen, by the combined Danish, Saxon, and Russian army, in such a manner, that he was obliged to sign a capitulation. Being now a prisoner, he was conveyed by order of his Danish majesty to Copenhagen, and so closely confined, that he was separated from all his attendants, except two domestic servants, who obtained leave to wait upon him, and was in other respects subject to great restraint and severity. At length, exhausted by miles, privation, and disease, he drew up, in the beginning of the year 1716, an account of his sufferings, to serve, to use his own words, as a confession to his disfriended relatives, and, at the same time, to preserve his name and reputation to posterity. This work was printed in 1773, in Lübom's "Anecdotes of celebrated and distinguished Swedes." He died in 1717, and was interred, with military honours, in the garrison church of Copenhagen. After the conclusion of peace, his body was conveyed to Sweden, and deposited in the cathedral of Uppsala. Stenbock was a man of large and varied attainments, always held in high estimation by Charles XII. In his political sentiments he adopted the system of his father-in-law, the celebrated Oxenstierna. He spoke his sentiments with freedom, and gave such advice as he thought most conducive to the good of his country. In speaking of the Polish war, in one of his letters, dated June 20th, 1702, he says, "according to every appearance, unless Providence interfere in a very remarkable way, war will be declared against the republic. How we shall get out of it God only knows. For my part, I would run no risk, but in a war really unjust, I would have no share in the deposition of Augustus, for whom he had a sincere effence. He incurred considerable blame for the severity which he exercised at Altona, and the ministers and generals of Poland and Denmark wrote to him complaining of his cruelty on that occasion; but Stenbock, who confided this measure, however harsh, as a just retaliation for the conduct of the Saxons and Danes at Stade, which they had bombarded and burnt to ashes, replied, "that he proceeded to such an extremity, in order to teach the enemies of his sovereign, in future, not to wage war like barbarians, and to cauie the law of nations to be respected." Gen. Biog.

STENBRUGGE, in Geography, a town of Norway; in the province of Aggerhus; 8 miles N. of Tonberg.

STENBY, a town of Sweden, in Esat Gotland; 11 miles E. of Nordkiopning.

STENCH. See STINK.

STENCILLING. See PAPER-Hangings.

STENCKBACH, in Geography, a river of Saxony, which rises 4 miles S. of Landberg, and runs into the Fulme, 2 miles N. of Zobitz.

STENDAL, a town of Westphalia, and late capital of the Old Mark, containing four churches, with considerable manufactures, introduced by the French refugees; 18 miles W.N.W. of Brandenburg. N. lat. 52° 56'. E. long. 13°.

STENDALICHEN, a town of Brandenburg, in the Ucker Mark; 10 miles N.E. of New Angermunde.

STENDORP, a town of the duchy of Holstein; 6 miles E.N.E. of Eutyn.

STENE, a town of Norway, in the province of Drammen; 48 miles E. of Drammen.

STENFORT, a town of Hinder Pomerania; 8 miles S. of New Stettin.

STENHEL, a town of Sweden, in Wetf Bothnia; 32 miles N.W. of Lulea.

STENO, NICHOLAS, in Biography, a distinguished physician, and subsequently bishop of Tittipolis, and vicar-apostolic of the northern countries, was born in Copenhagen in 1638. His father was a Lutheran, and goldsmith to Christian IV., king of Denmark. Having had the advantage of studying medicine and anatomy under the celebrated Bartholin, whose friendship he obtained by his ingenuity and industry, he was well prepared to profit by his travels through various parts of Holland, Germany, France, and Italy, in visiting the best schools, of which he gained several years. He was made a professor in 1660, and resided during the three succeeding years at Leyden, where he pursued his studies with the utmost diligence. He arrived at Paris in 1664, and at the end of two years more went to Vienna, traveled part of Hungary, and entered Italy by the Tyrol. He visited the principal cities of this fine country, and passed some time especially at Rome and Florence, in the latter of which cities his reputation reached the court of Ferdinand II., grand duke of Tuscany, who appointed him his physician about the year 1667, with a liberal salary. He was afterwards honored with the eeeen and confidence of Cosimo III., who made him as preceptor to his son. His attachment to the Protestant religion had been shaken by the eloquence of Bossuet while he was at Paris, and in 1669 he abjured that faith, and adopted the Roman Catholic persuasion. Frederick III., king of Denmark, invited him, near the close of his reign, to return to Copenhagen; but he refused the invitation, because he could not obtain permission to exercise the religion which he had adopted; but Christian V. repeating the invitation without any such restraint, about the year 1671, Steno returned to Copenhagen, and was appointed professor of anatomy. He found his change of sentiments and circumstances, however, productive of less agreeable results than he had anticipated, and he again quitted Denmark, and refused the education of the young prince of the house of Cosimo, at Florence. Some time after his return, he entertained a wish to enter the ecclesiastical state, and he embraced that profession in 1677. He was speedily nominated, by pope Innocent XI., to the bishopric in Ifaura, which we have already mentioned; and was afterwards appointed vicar-apostolic to all the states of the north, in which capacity he became a zealous preacher in Hanover, Munster, Hamburg, and various parts of Germany, and died in the course of his missionary labours, at Schwerin, in the duchy of Mecklenburgh, in 1686, in the 49th year of his age.

The works of Steno which are extant, relate principally to medical subjects. He was a zealous cultivator of anatomy, and the author of some discoveries relative to the minute circulation of the eye, the nape, and organs of voice, and to the lymphatics; as in the papers which he communicated to the Academy of Copenhagen, and his other works, will testify. The titles of the latter are: "Observationes de Oris, Oculorum, et Nariurn Vasibus," 1662; this was enlarged and reprinted in 1664, with the new title "De Muculis et Glándulis Observationum Specimen," "Elementorum Myologie Specimen, seu Muculi Descriptio Geometrica," 1667. "De solidio intra solidum naturaliter

Steno's Duó, a name given, from its discoverer, to the superior vaginal duct.

Several anatomists, particularly Heister and Palñyn, have disputed whether Steno's duct is pervious in recent foetuses, as well as in the skeleton. Dr. Kulm affirms, he has demonstrated it to several to be pervious in deer, bears, wild goats, hares, calves, and in the human subjects, and mentions the manner of tracing it. See Med. Edinb. Abridg. vol. ii. p. 431.


Gen. Ch. Cal. none. Cor. Petals four, distint, linear, equal, all turned to one side; their funnits ovate, concave, bearing the stamens. Neatly a gland, half embracing the tusk of the vessel. Stigma Filaments four, very fine, inserted into the hollow tip of each petal; anthers roundish, funk in the same cavity. Pith. German superior, flaked, oval, style terminal, cylindrical, deciduous; stigma oblique, dilated, orbicular, peltate, flatish. Peric. Follicle linear, flaked, coriaceous, recurved. Seeds numerous, imbricated, winged at the base.


1. S. Forsteri. Oval-leaved Stenocarpus. Br. Tr. of Linn. Soc. n. 1. (Embothrium umbellatum; Linn. Suppl. 128. Lamarr Dict. v. 2. 355. Illust. n. 1285. t. 55. f. 1.) Willd. Sp. Pl. v. 1. 158. E. umbelliferum; Fori. Gen. t. 8. f. a. f. — Leaves elliptic-oblong, obtuse, without prominent ribs.—Gathered by Forster in New Caledonia. The stem is shrubby, with alternate, round, smooth, leafy, dotted branches. Leaves alternate, on short thick stalks, coriaceous, smooth, entire, an inch or half and long; tapering at the base; obscurely triple-ribbed in a dry state. Flowers about half an inch long, red, about five or seven together, in axillary, flanked, smooth umbels, subtended by three or four small, membranous, ovate bracteae. Follicle near two inches long, like a small legume, with hollows for the seeds.

2. S. foetidus. Willow-leaved Stenocarpus. Br. ibid. n. 2. Prodr. n. 1. — "Leaves elongated, lanceolate; three-ribbed at the base."—Found by Mr. Brown, on the eastern coast of New Holland; on the rocky banks of rivers near Port Jackson. The flowers are of a yellowish-white. Umbels flaked. Whole shrub very smooth.


A genus of New Holland shrubs, either nearly smooth, or clothed with very fine greyish down. Leaves alternate, without veins; mostly undivided. Flowers few, solitary, single-flowered, without bracteae. Flowers either purple or yellow. Nut of the drupa often with only two cells, the others proving abortive.

"Bonita, though very nearly related to Stenochilus, differs in having the upper lip of its corolla emarginate, the lower three-lobed; a two-lobed stigma; and the nut of two divided cells, each with four seeds, according to the younger Gartner, in his v. 3. 168. t. 212."

1. S. glaber. Smooth Stenochilus. Br. n. 1. — "Leaves lanceolate or elliptical, undivided, smooth, scarcely longer than the flower; sometimes toothed at the extremity. Young branches downy. Stem diffuse."—Gathered by Mr. Brown, on the south coast of New Holland. This gentleman mentions another species, nearly akin to the present, except being hoary with down, which was gathered on the western coast of New Holland; but he leaves the description of it to his friend Lefchenault.

2. S. longifolius. Long-leaved Stenochilus. Br. n. 2. — "Leaves linear, somewhat lanceolate, elongated, undivided; hooked at the point; smooth when full-grown. Young branches downy. Stem erect."—Found also on the south coast of New Holland, by Mr. Brown. The flowers were past, but the habit, as well as fruits, answered to the preceding. The leaves are from three to five inches long.

STENOGRAPHY, SHORT-HAND, from roots; and γεωτρία. Passing over the Egyptian mode of writing by hieroglyphics, we may observe, that "The History of Hebrew Abbreviations, as a Key to understand the Rabbinical Authors," by the learned Buxtorf, appears to have unfolded one of the earliest notions mankind had of a method of short-writing. Some of these abbreviations are merely the incipit letters of several words joined together as one, and marked at the top with points; others are the final or terminational letters of words; and others, again, are contracted words, wherein two or three letters are made to denote an entire word.

The Jews, we are told, were particularly partial to these methods of abbreviation; to which they added a few arbitrary characters, to express certain proper names, such as God, Jehovah, and the like awful and sacred terms.

By degrees the Greeks acquired this mode of writing, and it was very successfully practised among them. Indeed, the Greek abbreviations and contractions have very much the character of genuine stenography.

It was at Nicolai that this method of writing was first introduced to the Greeks by Xenophon himself, who wrote by certain arbitrary notes, in the nature of characters. This opinion is confirmed by Laertius, who particularly notices two distinct methods of stenographic writing: namely, one by simple contractions; and the other by arbitrary marks or symbols.

The Romans practised this art at a very early period. Some writers have even ascribed to the poet Ennius the merit of having first invented a method of writing, by which the orators were enabled to follow the most rapid of their orators. This, however, is extremely hypothetical. It is added, that Ennius's method was much improved upon by Tyro, Cicero's freed-man; and still more by the learned Seneca.

Ennius, it appears, began at first to write with one thousand one hundred marks of his own contrivance, to which he might add, as circumstances and necessity de-

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manded. In what the subsequent improvements consisted we have no account; probably only in the invention of new symbols or characters, and not in any attempt to write in a short manner, by the combination of new and more simple letters.

It is evident the Romans held this art in great estimation; for Suetonius, speaking of Caligula, expresses his surprise, that an emperor, who, notwithstanding his numerous vices, was not deficient in capacity and parts, should remain ignorant of the art of stenographic writing. Titus Vespasian, however, in almost every respect a very different character from Caligula, is mentioned as being remarkably attached to short-hand, and himself practised it with great facility, and often made it not only his business but his amusement. He seemed to have great pleasure in calling his amanuenses together, and witnessing which of them wrote the fuller. He not only admired himself with stenography, but with imitating the hand-writing of others; and, by constant practice, acquired such a command of hand, and such a facility in imitation, that he was wont humorously to observe concerning himself, that he should have made an excellent mimic or counterfeit.

Various were the schemes, as at present, which were formerly used to write after public speakers; but they were probably all of them exceedingly arbitrary, and, for the most part, unintelligible to any but those who practised them; and, on that account, were soon forgotten and destroyed. The art was consequently much neglected, as is evident from two books of short-hand, mentioned by Triedemius. The first was a Short-Hand Dictionarius, which he bought of an abbot, a doctor of law, for a few pence, to the great satisfaction of the community to which he belonged, who had defined the short-hand marks to be erased, for the sake of the parchment on which they were written. The other was a short-hand copy of the Book of Psalms, which he met with in another monastery, where the monks had inscribed upon it, by way of title, “A Pfalter in the Armenian Language.”

Several copies, however, of a Dictionarius and Pfalter, in Roman short-hand, are mentioned as extant in different libraries; but they are in general the same method, as may be conjectured from those who mention them, and also from the appearance of an old short-hand Pfalter in the library of St. Germain, at Paris, carefully preferred as a stenographical curiosity. The late Mr. Byrom had a few pages of this transcript of his inscription and use.

Plutarch, in his Life of Cato, informs us, that the celebrated speech of that patriot, relating to the Catalinian conspiracy, was taken and preferred in short-hand; and there are numerous epigrams of Autolius, Martini, and Manlius, descriptive and commendatory of this art. But we must pass over all other ancient allusions and conjectures, observing, that, probably, the oldest method of short-writing at present extant or known is a Latin MS., entitled “Ar Scrybendi Caracteres,” or “The Art of Writing in Characters.” The author of this is not known, but it was printed about the year 1422.

We may just, however, remark on this head, that the ancient Irish alphabets, called Boholeath, a specimen of which may be seen in Ledwich’s Antiquities, and also in Dr. Fry’s Penographia, have much the appearance of some of our modern short-hand. Two of their alphabets were called Irith ogums: Celtic words implying letters written in cypher, and, indirectly, an occult science. They were first stenographic, then peganographic, then magical, and, lastly, alphabetic.

The Japanese alphabets (for they have three, two of which are in general use among the natives, the other only at court, and among the great) appear to have a stenographical character; most of them combining two, and others three, letters.

The two alphabets attributed to King Solomon, but upon what authority is not stated, by Thebeus Ambrosius, in his Appendices des diverses Lettres et des différentes Langues,” and cited by Delair, p. 139, have much the same cast in their formation; but the one, of which a beautifully engraved specimen may be seen in the Encyc. Franc. pl. xxv., partakes most of the nature of short-hand of any other yet mentioned. The Japanese has, in fact, but 328 sounds, which are all monosyllables, applicable to 80,000 characters, of which the whole language is composed.

Lambinon, in his “Recherches upon Printing,” observes, that modern stenography, which, like the telegraph, dates in France from the foundation of the republic, has neither the inconvenience, nor the obscurity, nor the danger of the ancient. The old characters varied under the hand of the copiers, and the sense changed according to the genius of the interpreters; so that their contractions are become so many enigmas, because we can refer to no other copies to ascertain the true reading, and because the authors are no longer in existence. “But,” continues this writer, “by the present system of stenography, the writers follow the words of the public orators, take down their speeches, the debates of the tribunal, or the lectures of the professors of the Lyceum, and produce a literal translation at last, in the usual characters and in print.” It is to be feared that this description of Gallic stenography is a little too highly colored; no system of French writing, that has hitherto come under our notice, having any such perfect facility of copying as is here stated; but, certainly, our neighbours across the Channel can both speak and write with wonderful rapidity.

The attempt of the late learned and ingenious bishop Wilkins to form a real character and philosophical language should not be overlooked. This pared-down, perhaps, more than all others, of short-hand, properly so called; but was not intended for much for expedition and brevity in writing, as for an universal communication or correspondence of ideas. Of its fitness for such a purpose, it is not the object of this article to discuss. We know a gentleman at this time, of great opulence and well-known character in the metropolis, who is of opinion, that he can express all ideas common to mankind in general by only three letters, which may be known all over the civilized world, and we believe it is his intention to make an experiment of the practicability of his scheme.

The art of short-hand was first attempted in this country by Dr. Timothy Bright, who published his “Charactère” in the year 1588. The “Writing School-Master” of Mr. Peter Bale, appeared two years after Dr. Bright’s work. Bale’s book is divided into three parts, the first of which is entitled “Brachypography,” and contains rules to write as fast as a man can speak with propriety and distinctness. In 1618 appeared Willis’s “Stenography, or Short-Hand Writing by spelling Charactères.” This method consists of ten alphabets, denominated words of fort; seven of which are composed of the initial letters of words; the rest, principally by the omission of unnecessary letters, and by symbolical figures.

Henry Dix’s “Brachypography” was an attempt to improve upon Willis’s; but all improvements of the art, till the invention of Byrom, were little better than the original—arbitrary and mysterious.
It is not requisite to detail the history of this art more minutely; nor to mention the numerous systems or methods, all tending to perfection, though each professing to excel its predecessors. We will, therefore, proceed to key before the reader such a system of stenography, which, if generally known and practised, would infallibly supersede the necessity of any other; and yet, it must be confessed, that the art of short-hand is far from having attained that perfection of which it may be capable.

The next system, as to beauty and practical utility, to the one about to be here developed, is doubtless that of Dr. Major's invention, who, however, candidly admits that, in the construction of his own work, he has proceeded upon Mr. Byrom's "general principles," which he owns, "must for ever form the basis of every future rational system."

Mr. Byrom's method of short-hand, as improved by Mr. Molineux, being now generally esteemed the best and most practical system extant, we shall give a brief yet comprehensive analysis of the whole, premising, that the rules which the inventor had prescribed to himself, in the execution of his plan, were,

1st. That all the simple sounds of the language should be denoted by the shortest and simplest marks in nature.

2dly. That those marks which were the shortest, and most easily formed, should be allied to the letters which are of most frequent occurrence.

3dly. That the letters which are most frequently combined in pronunciation, should be denoted by such marks as are most easily joined by the pen.

4thly. That all the marks of which any word may be composed, should generally be written without taking off the pen; and that the writing should not rise above or sink below the parallel lines, between which it should be uniformly comprised.

5thly, and lastly, That all the rules of abbreviation should be founded upon the properties of the language, and exemplified by the characters of the short-hand alphabet only, without the introduction of any arbitrary marks, either for abbreviation or any other purpose.

To unite so many different perfections in one scheme, and to make a regular and scientific system of the whole, was an undertaking of no common labour and difficulty. Mr. Byrom, the inventor, was well qualified for such an arduous undertaking, by a very extensive knowledge of the nature of language in general, and a thorough acquaintance with the properties and peculiarities of his own in particular; and it was by an indefatigable perseverance in making, through the course of many years, continual trials, alterations, and amendments, that he at last succeeded, to the satisfaction of himself and a few learned and judicious friends, to whom he first communicated the particulars of his invention. To remove any doubt which the public might entertain of its merit, these gentlemen, his scholars, drew up and signed a recommendatory description of his method of short-hand, which testimonial was prefixed, by way of preface, to the original publication.

Mr. Byrom's method of short-hand is there stated to be the best, consisting of all the words and phrases of the English language by a character which is perfectly regular and beautiful, and at the same time the shortest possible. Perfect beauty and regularity indeed, so far from being inconsistent with the greatest possible brevity, are in fact the only means of attaining it; and by a strict adherence to these principles, Mr. Byrom has completely succeeded in the invention and establishment of his system. In fine, his method of short-hand writing is no fanciful theory; but, on the contrary, is founded upon rational and philosophical principles: it pro-

poses nothing impracticable; it is not a mere jumble of awkward marks thrown together without order, and consequently unintelligible to the writer himself after the lapse of a few months or years.

For beauty, legibility, and the greatest possible uniformity in the writing, it stands unrivalled. It was a principal object with the inventor to expunge every thing arbitrary, both from the short-hand characters and the rules of abbreviation; and in this truly essential point he has succeeded so happily, that his system seems to claim pre-eminence over every other.

It may be useful to refer such of our readers as may wish to attain a complete knowledge of Mr. Byrom's system, to "An Introduction to Byrom's Universal English Short-Hand," by Mr. Molineux, of Macclesfield, explaining the theory of the art in a very clear and periphrastic manner, and to a supplementary work, entitled "The Short-Hand Instructor, or Stenographical Copy-Book," which exhibits the practice, adorned with its peculiar characteristics of ease and beauty. These two elegant little works form together a complete system of stenography, and have the merit of familiarising Mr. Byrom's excellent method for the general use of schools, and for the particular guidance of those who, without the assistance of a living instructor, may be desirous of a literary attainment, which is at once useful and ornamental.

The letter C, having always the sound either of k or s, is here represented by those letters respectively; z and ϭ, and also f and Ϫ, having a near affinity to each other in sound, are denoted by one and the same mark. The short-hand alphabet consists of the following consonants; viz. b, d, f, or ϭ, (the latter being easily distinguished, when necessary, by a thicker stroke,) g, h, j, k, l, m, n, p, q, r, s, or ϱ (distinguishing the latter, when necessary, by a thicker stroke,) t, w, x, y, ch, ß, and th. The vowels, viz. a, õ, Ϫ, or y, ρ, and u, though often omitted in short-hand, are easily represented in a dot or dots in five different positions, when preceding or following a single consonant, or when any of them are to be interposed between two consonants. When a dot stands alone, the vowel which is meant to be represented by it is easily ascertained, by observing what part of the space it occupies between the short-hand parallels; thus, a is meant if it be found at the top, u, if it be at the bottom, i, in the middle, &c.

11th. When any consonant stands by itself, it expresses some common word or particle, as denoted in the third column of the engraved table or alphabet.

12th. When a single consonant mark is prefixed, or placed close before any other characters, it denotes some common preposition, or leading part of a word. These prepositions are respectively given in the fourth column of the alphabet.

13th. When a consonant mark is subjoined, or placed close at the end of other marks, it signifies an appropriate termination or ending. These terminations are given in the fifth or last column of the short-hand alphabet.

From the easy and regular affixation of a threefold power or preposition to each consonant, a threefold advantage naturally follows. First, by allotting to each mark, standing by itself, a word or particle of which it is the start or some constituent part, we obtain a number of common words, some or other of them perpetually occurring, expressed by a single character, which otherwise would stand for nothing.

Secondly, The prepositional part of a word being designated by its leading consonants, placed near, but not joined to the following part of it, secures alike the beauty and
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and brevity of the characters, which in many cases could not otherwise be maintained.

Thirdly, A similar advantage is gained by representing the terminational part of a word by an appropriate confluence of characters, not by a word, but postposed at the end of the word. Characters, when, by the mutual help of each other, they describe long and complex words in a neat and concise manner, and are easily distinguished from all others.

Two marks, it will be seen, are allotted to the consonant B, and they are each used, when standing alone, to denote two different words, the first is, and the second but. The principal reason, however, for assigning two marks to the same consonant, is to secure a more easy combination of the marks in writing, the first being used, for instance, before a defending character, as bo or bi, and the latter before one which acends, as br or bl. The first character is generally written upwards, but the second is always made downwards.

Ufed as a preposition, the first denotes ke; and the second, used as a termination, represents -ible or -ible.

One of the most common terminations in our language is denoted by the letter D, which the learner will observe stands for the word and when written separately, for ds as a preposition, and for ed as a termination. This letter is never written upwards, and the same rule will invariably apply to all those characters, whether curved or straight, that are strictly perpendicular; the oblique letters may be written either upwards or downwards.

Neither prepositions nor terminations are invariably detached from the roots of their respective words. It is difficult to lay down any precise rule for this; certainly in cases wherein the preposition or termination can conveniently be joined, it would be a needless waste of time to lift the pen. Much, however, depends upon the degree of force or importance which the termination may add to the correct pronunciation of the word, in writing the phrase, a learned man, be is learned in the law, &c.; it is not chaste to say a learn’d man, learn’d in the law. On this account it will admit of a question, whether it would not be more correct to detach the termination ed in short-hand, notwithstanding it will so conveniently join in this word. And here let the learner observe, once and for all, that he should acquire such a method of writing short-hand as will create the least possible ambiguity, or difficulty in reading it; and this can only be done by adhering as much as possible to the rules of a correct orthography and pronunciation.

The letters F and V are always written downwards. In cases where dispatch is not required, the letter v may be denoted by writing the character a little thicker. And this distinction is not only convenient, but perfectly rational: there is a kind of affinity betwixt the sound of the letter v, and the thickened of the line by which it is expressed; the letter f has, to use such a term, a thinner sound, and may fitly be denoted by a thinner character; the sound of f and v, however, is so nearly the same, that the same shaped character is very properly used for both letters. These remarks will apply to the letters r and s; in which is the same similarity of sound, shaded by the same respective strength in the pronunciation.

This character, as a word, stands for of; prefixed to other characters, it represents the preposition for; and, as a termination, -ify.

The letter Q is represented on the Short-hand plate by a character which is to denote both the hard and the soft sound of that letter. In the latter capacity, it is occasionally used instead of f. Standing by itself, it is a note, when written at the top of the line, the word again, and at the bottom, against. It has no prepositional or terminational character.

H is denoted by two characters, but the first only is to be considered as the proper representation of that letter. It is written downwards from the twirl. The other character might very well have been dispensed with, but being retained in the alphabet, may fill be used fling to denote the word bad; and notwithstanding the twirl is at the bottom, it is better to write it downwards. The first character stands for the word base.

When it is requisite to write the words bat, bit, bot, but, or any others beginning with b, and ending with t, with one or more vowels in the middle, the vowels may be indicated by placing the vowel in its appropriate position with reference to the line, but out of its usual order in other respects, vis., immediately before the consonant, and not lengthening the last letter, or t, below the line. By writing the letter r, in the words bitter and bitherto, only half its usual size, the t in the former part of the word denotes tb.

The letter J having been accidentally omitted in the plate, it is supplied here by the following characters ʒ, ʒ, standing, when written separately, for the words judge, and just; but the first only is the proper mark for the letter, the second character standing in a similar situation to the last character for b; being in a manner unnecessary, when ufed, however, it must be written downwards. There are some infinates in which the letter g may be used for j.

The next letter, K, is a very important one; for it represents the c hard, and of course is the initial letter of all those words beginning with that letter, and in all other places where it is required: it is also the first letter in words beginning with k. The soft sound of the letter c is expressed by the letter s; and sometimes the b and g are used prumiscuously for each other, whenever greater facility, convenience, and beauty of joining, may by such means be obtained. This character being, moreover, an horizontal one, may be placed at the top, middle, or bottom of the short-hand space or line. When written at the top of the space, it stands for cas; and at the bottom, for could or couldst. As a preposition, it represents, at the top, middle, or bottom, com-, con-, and contra-: in the middle of the space, it denotes the terminations -ical or -ical.

Cn and cn occurring very frequently at the beginning of words, the corresponding characters may be shortened, by cutting off the horizontal part of the letter b or c, and commencing the next letter, m or m, immediately after the formation of the twirl. This will, however, apply only to the commencement of words.

L is represented by three characters, of which it may be observed generally, that in all of them the twirl is formed to the right hand. When written fling, the first character denotes the word all, the second always, and the third altogether.

M, and indeed the horizontal characters generally, are of frequent and important use in short-hand. This letter, when written at the top of the space, represents the word am, and at the bottom among, or amongs. As a preposition, at top it is magni- in the middle mid- and at the bottom omni-. Used as a termination, it is ment; and it is customary, in this case, to write it at the top of the line.

N, the letter m reversed, is also of frequent use. As a different word, it stands am for at the top, nm in the middle, and under at the bottom. Prepositionally, it is anti- or anti-, inter- or in- and at the bottom, under- or un-. As a termination, it stands for -eat at the top, and -et at the bottom; but when used in the latter case, it is customary
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omary, to add a short s, or horizontal straight line, to it. Both this and the letter m, when used as a preposition or termination, should be made somewhat less than the usual alphabetical size. The same observation will apply to the letters b, d, r, t, w, &c.

P is the same letter in a perpendicular position, and is, in fact, the d reversed. As a word, it stands for upon; and as a preposition, for per-, pre-, or pre-. It may also occasionally be used for pe-

Q is the 1 reversed. In the middle, and at the end of words, it is frequently used instead of that letter. Used flangly, it is the word quaestion.

R is the oblique character used for f, with its inclination to the right, and may be written either upwards or downwards, according to the nature of the marks which may happen to precede or follow. When not joined to other characters, it is always supposed to be written downwards; and in that case the vowels are, of course, reckoned from the top downwards. As a word, it stands for for; and as a preposition, for re-; and as a termination, for -ery and -ing. The plural of which may be denoted by a small s added to it. It is seldom necessary to use the detached preposition re- in short-hand, except when the consonant which follows that preposition does not admit of being conveniently joined to the letter r.

S, or Z, expressed by a straight horizontal line, as being made a little thicker if necessary, is a letter of infinite service in our language, and in short-hand particularly. It is, as before observed, the soft. At the top, when used independently, it stands for as, in the middle for is, and at the bottom for us. By the same rule of position, it stands for the prepositions satir-, circum-, super-, and sub-. And, again, as a termination, according to the order of the vowels, for...-

T is a perpendicular line or stroke. As a word, it stands for the; as a preposition, for trans; and as a termination, for -ty. It should uniformly be written downwards.

When two s’s form a word, or part of a word, a little break must be made, to signify that such is the case. This may be done without lifting the pen; but only very lightly, moving it on the paper to the right, before the last letter is committed.

This letter, in short-hand, is often used to denote th, which is done by making the adjoining consonant, either preceding or following the t, only half its usual size: thr, thb, &c. are very conveniently so signified. In all other cases, a letter of half the size denotes that the adjoining character is to be resolved into two letters or parts; as, when in the words terror, proper, &c. the first letter is made small, and the other, the r, is its usual length: this, however, should be referred to as seldom as possible.

V is the oblique letter f, made a little thicker when needful.

W has two characters, of which the first is the proper one for the letter, as in the case of j and b. This character stands for will, the other for would and wouldst, and is written downwards: as a preposition, it is with; and as a termination, -ward and -wardly. With respect to the use of the letter s, in union with w, see the observations on b respecting that point.

X has also two characters, but the first only is used as the letter. The one stands for except, and the other for extra. As a preposition, it is ex- and extra-. The letters k and g will often express the sound of this letter.

Y is used only at the beginning of words, and for the word yet. At the end and in the middle of words, the vowel i is always used.

Z is the same as s, made thicker, when needful.

Ch are denoted by a character resembling the short hand g reversed, and stands for the word which. When founded hard, like k, as in words from the Greek, it is not used, but this letter used instead of it.

Sh have two characters, but the first is the proper representative of these combined letters. This character stands for the word shall, and the other for should and shouldst.

As a termination, it is used for -ship.

As a very frequent combination of consonants, are denoted by two characters, either of which may be considered as the legitimate representative of the united letters; but Mr. Molineux prefers the latter, which is used for the word that; the first in the formation of words only.

Et cetera. This common abbreviation is denoted by a t, and a small s or e soft, drawn from the e’s place.

Thus have we gone through the alphabet, as exhibited on the plate; and the reader, by comparing the one with the other, may readily acquire a pretty competent knowledge of the leading principles of this system of short-hand writing. So far appears to be every thing that is absolutely necessary to lay down by way of instruction to learners wishing only to acquire so much knowledge of stenography as will enable them to use it for the convenience of epistolary correspondence, for the purposes of literature and study, in the writing of common-places, making extracts, private memoranda, &c.

But as there is a higher and more desirable object to be attained by the practice of this art, viz. that of taking down the speeches of public orators, trials, &c. it is essential, to effect this object, that a still more concise method of writing should be acquired; and this may be accomplished by attention to the simple rules given in the following short extracts, abridged from Mr. Molineux’s excellent treatise.

Of Abbreviations.—An alphabet, formed upon the most just and natural plan, by which, with the help of a few general rules, all the words of the language to which it is adapted, may be easily, neatly, and speedily written, will not alone be sufficient to satisfy the expectations of an inquisitive reader; who must be sensible, that however complete the alphabet may be, yet many compendious applications of it may be obtained by an inquiry into the nature of our language, and the abbreviations of which it admits. He will not be satisfied with being only taught how to express all the letters of a word by the shortest and easiest strokes, but will also require further instructions how to describe intelligibly words and sentences, by as few of those strokes as possible. To investigate from a few things given, many which are omitted, will be found not only the capacity of the learner’s faculty, but if the few be properly given, the sense of the passage, and a due attention to the idiom of our language, will render the discovery of the omissions more certain, and also less difficult, than the unexperienced would be apt to imagine. Without some rules of abbreviation, one end of short-hand, that of following a speaker, would fearfully be attainable.

It may be proper, however, to advise the learner not to embarrass himself with short-hand abbreviations, till, by a competent
competent practice of writing according to the rules already laid down, he is become so well acquainted with the characters, as to be able to write and read them with nearly as much ease as common long-hand. He will then meet with little more difficulty in reading words contracted, than he formerly did in those written more at length, provided that the rules of abbreviation be duly attended to. A summary of the principal rules and most practical methods of abbreviation is here given, and it is left to the skill and discretion of the writer, by observing their nature, and proceeding upon the same principles, to make such farther advances and improvements as his occasions may require.

A brief Summary of the principal Rules of Abbreviation.

Rule 1.—To join the auxiliary verbs, the particle not, and the pronouns together; as can be, have been, may be, cannot be, he must be, ought not to be, &c.

Rule 2.—To join the marks in an unusual manner, in order to shew that each particular mark denotes a word, and not a single letter; as in the, it is, as it is, since it is, it was, it was not to be, &c.

Rule 3.—Derivative substantives may be very conveniently represented, by placing a point at the end of the words from which they are derived. Derivative adjectives and adverbs may be represented also by points, distinguishable by their situation, both from the substantive and the vowel points; which may be done by placing them in a line, which, if produced, would pass through the substantive point, and would also be peculiar to the last substantive mark; one placed before the substantive point, signifying the adjective, one after it, the adverb; as, forgetful, forgetfulness, forgetfully; reasonable, reasonably, reasonableness; sufficient, sufficiently, sufficiently.

No great accuracy is necessary with respect to the adjective and adverb points, provided they be placed so as to be clearly distinguished from the vowel and substantive points.

Rule 4.—Such words as, either by their particular relation to the subject, or frequent occurrence, are easily discoverable, however concisely written, may be denoted by the first letter, if they begin a substantive, or by the first vowel and consonant, with the adjective, substantive, or adverb point annexed; as, life and mortality are brought to light by the gospel; the resurrection of the dead, and a future state of rewards and punishments, are plainly and positively taught in the gospel. The adjectives which usually accompany such substantives may also be denoted by their first consonant, joined to the substantive; as, with humble submission to your lip.

Most writers of short-hand accusm themselves to mark such words as most frequently occur in their own particular professions, by the initial letters only, with the substantive, adjective, or adverb points, which, through custom, easily suggest those words to them at first sight. But it must not be understood, that those marks imply those words exclusively, and no other. They may stand for any other beginning with the same letters, which the sense of the passages necessarily requires.

Rule 5.—A dot placed at the point of concurrence of two consonant marks, denotes two substantives, of which those marks are the first consonants; and also that the latter is governed of, or connected to, the former by some preposition, which is omitted; as, the love of money is the root of all evil; seek ye first the kingdom of God, and his righteousness, &c.; the effects of gravity are visible in every part of that system to which we belong, but the cause of gravity still remains undiscovered.

And if an adjective precedes either of the substantives, they may all three be represented by their first consonants joined together, with the dot always placed at the end of the first substantive; as, the great goodness of God is manifested in all his dealings with his creatures; his majesty the king of Great Britain.

Rule 6.—The substantive point, placed before a single consonant mark, denotes that the substantive is to be repeated, with some intervening preposition; as, day after day; from time to time.

Rule 7.—The substantive, adjective, or adverb point, placed before two or more consonant marks joined together, denotes two or more substantives, adjectives, or adverbs, of which those marks are the first consonants, and also that they are connected by a conjunction; as, the precepts both of natural and revealed religion forbid us to do our neighbours any injury; what doth the Lord thy God require of thee, but to live soberly, righteously, and godly in this present world.

Rule 8.—Many long words, especially those in which the marks for the consonants will not join neatly, may be denoted by their first syllable, with as many points annexed as there are syllables wanting; as, multitude, correspondence. And when great dispatch is required, the points may be omitted, especially if the words do not begin with prepositions; as, specification, difficulty, negligence.

Rule 9.—Words beginning with prepositions may be denoted by their respective prepositions, together with the next consonant and vowel, and sometimes with the next consonant only, adding, if necessary, the substantive, adjective, or adverb point; as, deliberate, transtimation, recommendation, confounding, &c.

The participles may be abbreviated after the same manner, by adding, instead of the points, the terminations ing or ed to the latter consonant mark; as, considering, considered.

Words beginning with double or treble prepositions, may be written after the same manner, joining the prepositions together; as, representation, misrepresentation, incomprehensibility. If two substantives begin the next syllable, the writing of them both will help to discover the remainder of the word; as, misunderstanding, transtination.

Rule 10.—Words ending in any of the terminations which in the alphabet are denoted by consonant marks, may be expressed by their first consonant and vowel, together with the proper mark for its termination; as, arbitrary, opportunity, curiosity, lawfulness.

Rule 11.—Such words as are easily discoverable by the particular prepositions which they require, may be denoted by their first consonant only; as, this belongs to me; he made some good observations upon it; we must guard against such passions as we are most liable to.

As few English words end with the syllable are, the preposition to may be joined to the preceding word, which is signified by its first consonant only; as, this belongs to me, liable to, satisfactory to.

Other prepositions which are denoted in the alphabet by a single consonant, may, in like manner, be joined to the preceding word; as, he made some very good observations upon it.

Rule 12.—Prepositions generally require after them either a noun or pronoun. The pronouns being few in number, and some of them used as substantives, or adjectives, for nouns, must occur very frequently, and by that means soon become familiar to the learner; pronouns, therefore, may be joined to the prepositions, without danger of creating any difficulty to the reader; as, to me, to you.

Rule 13.—The preceding word, the preposition, and pronoun, may be joined all together; as, belongs to me, extends to us, agreed with me, depend upon me, observations upon this.

The words same, any, none, which, such, best, &c. followed
lowed by a preposition and pronomes, may be denoted by
their first consonants, and may be joined to the preposition
and pronomes; as, some of them, any of us.
Rule 14.—The adverbs preceding the verbs, and the sub-
stantives following the pronominal adjectives, may be joined
to the verbs and adjectives respectively, denoting both the
adverbs and substantives by their first consonants, or at most
by their first consonants and vowels; as, "you may safely de-
part upon my account."

Rule 15.—Many common phrases, formed by a substan-
tive preceded by the prepositions with, without, in, &c., and
followed by to, of, &c., may be very conveniently abbrevi-
ated; as, with regard, with or, in order to, to, in con-
sequence, comparison, or consideration of.

Rule 16.—Common adverbial phrases are, in like manner,
often denoted by their initial consonants joined together; as,
at the same tome, at present, in this manner, in like manner,
in a great measure, in the same manner, in the mean time, in
general, in particular.

And when the proportion of equality is expressed, with
some one word intervening, they may be all joined together;
as, as much as, as well as, as soon as.

Rule 17.—The conjunctions which may be made, when it
is or it was, are followed by an adjective, and to or that, are
very numerous; as, it is impossible, it was unnecessary, it
is contrary to, it is according to.
STENOMARGA, in Natural History, a name used by
some authors for a light marly earth, more usually called
epicurus minerals, and late luna by the later writers, and terra,
or creta Selenehcyca, by Dioecides and Galen.

STENOSA, in Geography, an island in the Grecian Ar-
chipelago, about 10 miles in circumference, inhabited only
by a few goats and their keepers. N. lat. 37° 5'. E. long.
25° 55'.

STENSKAR, two or three small islands on the W.
sie of the gulf of Bothnia. N. lat. 65° 12'. E. long.
21° 40'.

STENSITZ, a town of Poland, in the palatinate of
Sandomirz; 30 miles E. of Radom.

STENTATO, an Italian musical term, given by Brof-
ward, which no longer occurs in musical works at present.
It seems to have been superceded by Sforzando.

STENTEROPHONIC TUBE, a speaking trumpet, so
called from Stentor, the vociferous Stentor, celebrated by
Homcr (Ilad, lib. v.) as the most illustrious throat-per-
former, or herald of antiquity:

"Stentor the strong, endued with brazen lungs,
Whose throat surpass'd the note of fifty tongues."

Pope observes on this passage, that "there was a necessity
for cryers whose voices were stronger than ordinary, in those
ancient times, before the use of trumpets was known in their
armies. And that they were in esteem afterwards, may be
seen from Herodotus, where he takes notice that-Darius
had in his train an Egyptian, whose voice was louder and
stronger than that of any other man of his age."

The speaking-trumpet, under the title of the Stentero-
phonie tube, was long ascribed in England to sir Samuel
Moreland; but Kircher has formally laid claim to it in his
"Mufurgia," however, the Stentorophie horn or tube of
Alexander the Great claims primogeniture, as well as su-
perior magnitude; for it is said that he could give orders to
his army at the distance of 100 stadia, which is above twelve
English miles. See Trumpet.

STENWICK, in Geography, a town of Norway, in the
province of Drontheim; 24 miles S.W. of Drontheim.

STENYCLARUS, in Ancient Geography, a town of Lo-
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conia, upon the river Pamyus, N. of the gulf of Messenia;
where Crephonte, one of the chiefs of the Heraclidae,
established his residence, and which he made his capital, so
that it was called a royal city, or βασιλικὸς.—Allo, a plain of
Messenia, W. of the river of Paunfania, known on account
of a battle very disastrous to the Lacedaemonians, in the year
684 B.C. Paunfania places this plain on the road from Meg-
ara, in pass of Arcadia to Ithome.

STENZYLE, in Geography, a town of Poland, in Vol-
bynia; 15 miles N.E. of Luckow.

STE. See Pack, Stair, &c.

Steps, in Ship-Building. Steps for masts, into which their
heels are fixed, are large pieces of timber. The main and
fore-step are fixed across the keel, and that for the
mizen-mast upon the lower-deck beams. The hole, or mort-
tice into which the heel of the mast steps, should have suf-
cient wood on each side, to accord in strength with the
tenon left at the heel of the mast, and the whole cut rather
less than the tenon, as an allowance for shrinking. The step
for the capstan is a solid lump of oak, let down between
the beams, in which the spindle at the heel of the capstan
traverse in an iron cup. Steps for the ship's fide are pieces
of oak quartering, with tenonings, nailed on the fides at
the gangway, about nine inches aunder from the wales upwa-
dards, for the convenience of getting up the fides.

Step, or Tongue, in Rope-Making, for the tar-kettle, is
made of three-inch oak-plank, five feet long and thirteen
inches broad, which tapers to nine inches at the bottom,
and is put into the kettle through a mortise in the bridge.
Within four inches of the lower end of the step is a round
hole five inches diameter, for the yam to pass through. The
step is suspended and regulated by a tackle.

Step and Leap, in the Manege, one of the seven airs or
artificial motions of a horse, consisting, as it were, of three
airs: viz. the pace or step, which is terra-a-terra; the
jumping before, which is a curuet; and the whole finished with
a fault or leap, which is a capriole.

This manege is infinitely less painful to a horse than the
capriole; for when you dress a horse to the capriole, he will
of himself take to this air for his ease and relief; and in time
those horses which have been drest to the caprioles, will
execute only balotades and croupades, unless particular care
is taken to make them yerk out.

It is this, likewise, which, next to running a brisk coure,
enliven's and animates a horse most: to reduce a horse to the
jufness of this air; you must begin by emboldening and
making him lose all fear of correction, teaching him to keep
his head steady, and in a proper place, lightening his fore-
parts by putting him to make pefades, and teaching him to
know the aid of the switch, the fame as in the lefton of the
capriole, and by giving him a firm and good appu, and
full in the hand; though it is certain that the step contrib-
utes to give him this appu, inasmuch as that it puts him in
the hand; besides, that it gives him strength and agility
to leap, just as we ourselves leap with a quicker spring
while running, thus if we were to stand quite still and leap;
therefore, most old horses generally fall into this air.

When your horse is sufficiently knowing in these several
particulars, teach him to rife, and hold him in the air; then
let him make three or four pefades, and afterwards let him
walk four or five steps low and equal. If he forces the
hand, or retains himself too much, he should be made to
trout these four or five steps rather than walk: after this,
make him rife again, and continue this lefson for some
days.

When he is so far advanced as to comprehend and un-
stand this sufficiently, begin by putting him to make a
U
pefade;
pèfades; demand then a leap, and finith by letting him make
two pèfades together.

There are two things to be observed, which are very
efficient in this lefson: one, that when he is to make the
leap, he should not risé so high before as when he makes
pèfades only, so that he may yerk out with greater ease and
liberty; the other caution is always to make your last pè-
faide longer and higher than the other, in order to prevent
your horse from making any irregular motions, by shuffling
about his legs, if he should be angry and impatient, as well
as to keep him in a more exact obedience, and to make him
light in the hand, if he is naturally heavy and loaded in his
fore-parts, or apt to lean too much upon the hand.

Again, reduce the third or fourth pèfade into a leap, as
you did the first, then make two pèfades following; and
after this, let him walk quietly four or five steps, that he
may make again the same number of pèfades, and in the
same order. In proportion as the horse begins to under-
stand, and is able to execute these lefsons, you should aug-
ment likewisè the leaps one by one, without hurrying or
changing their order, making always between two leaps a
single pèfade, but lower than thefe in the first lefson, and
then two more again after the last leap, and sufficiently
high.

By degrees the horse will grow active and light in his
hinder parts; you must raise him then higher before, and
support him longer in the air, in order to make him form
the leaps perfect, by means of prudent and judicious rules,
often practised and repeated.

If a horse forces the hand, or preties forward more than
you would have him, either from heaviness of make, or from
having too much fire in his temper; in this case, you should
oblige him to make the pèfades in the same place, without
stirring from it; and instead of letting him advance four or
five steps, you should make him go backward as many.

This correction will cure him of the habit of prelling for-
dward, and forcing the hand. Upon this occasion, likewisè,
you should use a hand-spur to prick his croup, instead of a
switch.

To make this air just and perfect, it is necessary that the
action of the leap be finished as in the caprioles, except
that it ought to be more extended; and that the pèfade, which
is made between the two leaps, should be changed into a
time of a quick and short gallop; that is, the two hinder
feet ought to follow together in a quick time, and briskly;
the fore-feet, as in curvets in the meazir; but in this the
horse should advance more, not be so much together, nor
rise so high.

The perfection of this time of the gallop depends upon
the justness of the horseman's motions. They ought to be
infinitely more exact in this lefson than in the caprioles,
or any other airs which are performed straight forward.

In reality, if the horseman is too flow, and does not catch
the exact time which parts the two leaps, the leap which
follows will be without any spring or vigour, because the
animal so restrained and held back can never extend himself,
or put forth all his strength. If he does not support and
raise his shoulders sufficiently high, the croupe will then be
lower than it ought to be, and this disproportion will force
the horse to tosé up his nose, or make some other bad mo-
tion with his head, as he is coming to the ground in his
lep; or else it will happen from this, that the succeeding
time will be so precipitate, that the next leap will be falle
and imperfect, as the horse will not be sufficiently united,
but will be too heavy, and lean upon the hand. If he is not
together, the leaps will be too much extended, and conse-
quentially weak and loose; because the horse will not be able
to collect his strength, in order to make it equal to the
first.

Learn then, in a few words, what should be the horse-
man's feat, and what actions he should use in this lefson:
He should never force, alter, or lose the true appui,
either in raising, supporting, holding in, or driving forward
his horse.

His hand should be not only firm and steady, but it is
indispensably necessary that his seat be exactly straight and
just; for since the arm is an appendix of the body, it is cer-
tain that the motions of the horse shake or disorder the body
of the rider: the bride-hand must inevitably be shock, and
consequently the true appui destroyed.

In this attitude then approach the calves of your legs,
support and hold your horse up with your hand; and when
the fore-part is at its due height, aid with the switch upon
the croupe.

If your horse rises before, keep your body straight and
firm; if he lifts or tosés up his croupe, or yers out, fling
your shoulders back, without turning your head to one side
or the other, continuing the action of the hand that holds
the switch.

Remember that all the motions of your body be so neat
and fine, as to be imperceptible: as to what action is the
most graceful for the switch-hand, that over the shoulder
is thought the belt; but then this shoulder must not be more
back than the other; and care must be taken that the motion
be quick and neat, and that the horse do not see it so plainly
as to be alarmed at it.

It is said, that when the horse makes his leps too long
and extended, you should then aid with the hand-spur, and
for this reason, because the hand-spur will make the
horse raise his croupe without advancing, as the effect of
the switch will be to raise the croupe, and drive the horse for-
ward at the same time; it should, therefore, be used to such
horses as retain themselves.

Remember that you should never be extreme with your
horse, and work him beyond his strength and ability: indeed
one should never ask of a horse above half of what he can
do; for if you work him, he will grow languid and tired;
and his strength and wind fail him, you will be compelled to
give your aids rough and openly; and when that happens,
neither the rider nor the horse can appear with brilliancy
and grace. Berenger's Horsemanship, vol. iii. ch. 21.

STEPAN, in Geography, a town of Poland, in Vol-
hynia; 15 miles N.E. of Luckow.

STEFENITZ, a river of Mecklenburg, which joins
the Trave, at its entrance into the Baltic.—Alto, a river
of Saxony, which runs into the Elbe, near Wittenberg.—
Alto, a town of Hinder Pomerania; 6 miles N.W. of
Golnow.

STEPHANE, in Ancient Geography, a town of Asia,
in Paphlagonia, upon the coast of the Euxine sea, with a
port, where vessels were secure, between Cimolis and Po-
tani, according to Arrian.

STEPHANHOUSSKO, in Geography, a town of Bo-
hemia, in the circle of Chrudim; 16 miles N.E. of
Chrudim.

STEPHANIA, in Botany, so named by Loureiro,
from στέφας, any thing encircling the summit of some-
ing else; whence comes στέφας, a crown; and hence the above
appellation alludes to the anther, "which surrounds the head
of the filament, like a crown of gold."—Loureir. Coehinch.
Sarmentaceae, Linn. Alphanagi, Jull.

Gen. Ch. Male, Cal. Perianth of six rather acute,
spreading leaves; the three alternate ones smaller. Cor.
Petales
name given by this author to Aublet's *Palicourea*. (See that article.) The genus itself is, however, abolished, Dr. Swartz having reduced it to *Pachytopia*. Fl. Ind. Occ. v. 1. 433, in which he is followed by Wildenow, Sp. Pl. v. 1. 971. These authors call Aublet's plant *Pachytopia Palicourea*. It is a native of Guiana and the West Indies. *Stephanium* would be too near *Stephania*, if the genus of Schreber and Aublet were a good one.

**Stephankowice**, in *Geography*, a town of Poland, in the palatinat of Belz; 34 miles N. of Belz.

**Stephanophorus**, *Crown-Bearer*, in *Antiquity*, the chief priest of Pallas, who presided over the reft. It was usual for every god to have a chief priest; that of Pallas was the Stephanophorus, just mentioned; and that of Hercules was called Dadochus.

**Stephanowze**, or *Stephanestih*, in *Geography*, a town of European Turkey, in Moldavia, at the confluence of the Pruth and the Bafsou; 40 miles N. of Jaffy. N. lat. 47° 53'. E. long. 27° 30'.

**Stephansberg**, a town of Germany, in the principality of Anspach; 4 miles N. of Maynbernheim.

**Stephansdorf**, a town of Sile sia, in the principality of Neisse; 4 miles N.W. of Neisse.

**Stephante**, a town of Asiatic Turkey, in Natolia, on the coast of the Black Sea; 9 miles N. of Sinob.

**Stephanus, Byzantius**, in *Biography*, a grammarian who flourished, as it is conjectured, about the close of the fifth century, was professor in the imperial college of Constantinople, and composed a dictionary containing nouns-adjective derived from the names of places; and designating the inhabitants of those places. Of this work there exists only an abridgment, made by Hermolaius, and dedicated to the emperor Justinian. This work is known by the title *Theon*, de Urbibus; but that of the original was *Ewos*; hence it has been inferred, that the author's intention was to write a geographical work. Much of the value of the original is unquestionably lost in the abridgment; yet learned men have derived considerable light from it; and it has been an object of critical illustration to Casaubon, Scaliger, and Salmasius. It was printed in Greek at Venice, in 1502, under the superintendance of Aldus Manutius. An edition of it, with a Latin version, was published at Amsterdam, in 1678, by Pineda, a Portuguese Jew; and ten years after this, an edition was printed at Leyden, with a translation by Abraham Berkelsuus, who added a very copious commentary. This edition was not completed when the learned editor died, and it was finished by James Gronovius. A fragment of the original, relative to Dodoza, is extant; and an edition of it was given by Gronovius.

**Stephen I., Pope**, succeeded Lucius about the year 234. His pontificate was rendered memorable by his dispute with Cyprian, bishop of Carthage, concerning the baptism of heretics. Stephen had already displayed a degree of temperance, by pronouncing the restoration of Basilides and Martialis, two Spanish bishops, who had been deposed by the other prelates of that country, and who went to Rome to appeal to the pope. Cyprian, in this discussion, maintained that baptism by heretics could not be valid; an
STEPHEN.

an opinion which was confirmed by a council of seventy-one bishops, held at Carthage. Their determination was sent to the pope, who not only rejected their decrees, but enjoined them, under the penalty of excommunication, to renounce their decrees; and he concluded with some severe re-

Stephen II, pope, a presbyter, was chosen in 752 to succeed Zachary, but who died within a few days of his election, and before he could be consecrated. He is omitted by all the ancient authors in the papal catalogue, but by later writers he has been admitted, upon the principle that election alone confers the papal authority, and that he is therefore to be regarded as a real pope. He was suc-

Stephen III, who was elected in the same year. He was a native of Rome, the son of a perfon named Constan-
tine, and had acquired the dignity of deacon of the Roman church, when he was chosen to fill the pontifical chair. At this time Aëtaphus, king of Lombardy, who had made himself master of all the exarchate of Ravenna, threatened Rome, requiring its submifion, and the payment of a tribute. The pope attempted to divert him from his de-
signs, but without effect; the haughty monarch invaded the city, nor could he be deterred from his purpose by the solici-
tation and threats of the emperor Constantine. The ponti-
fiff applied now for the aid of Pepin, king of France, who received him into his court with every mark of respect. Here he was taken ill, but having recovered, he solemnly anointed Pepin, with his queen and two sons, in the church of St. Denis. The king then marched with an army into Italy, taking the pope with him, and besieged Aëtaphus in Pavia, who was obliged to submit to the terms of reftoring to the church all the territories which he had feized from it, and also of relinquishing the exarchate of Ravenna. No sooner, however, had Pepin repelled the invader, than Aëtaphus resumed his arms, and marched to Rome, to which he laid siege. Stephen had again recourse to his protector, imploring him, in the most urgent and pathetic manner, to come to the relief of the holy fee in its imminent danger. He also employed some artifice for rendering effectual his entreaties, which was to write a letter to Pepin in the name of St. Peter, calling upon him in his own perfon, and that of the Blessed Virgin, to hasten and rescue his favourite people. Pepin did not wait for the second invitation, but immediately on hearing of the danger of the pontif, marched without delay, and laid siege to Pavia. Aëtaphus was now obliged to raise the siege of Rome, and enter into a treaty, by which he confirmed the former terms, with some farther sacrifices. Pepin then caused an instrument to be drawn up, signed by himself and his sons, by which he ceded for ever to the holy fee all the places thus yielded up by the Lombard king, including the exarchate, which he had taken from the emperor of Constantinople. He afterwards caufed the incenfe of donation, with the keys of all the cities, to be laid on the tomb of St. Peter in Rome. Stephen had thus the honour of being the founder, or first possessor, of the temporal grandeur of the pontificate. He died in April 757, after having fat in the papal chair somewhat more than five years. Seven letters, and a collection of canonical constitutions, are extant under the name of this pope.

Stephen IV. (III.), born in Sicily, came to Rome in the pontificate of Gregory III., and was in great esteem with several succeeding popes. He was titular priest of St. Cecilia at the time of the death of Paul I., in the year 767. On that event, Toto, duke of Nepi, coming to Rome with an armed band of friends and valets, caused his own brother, Confiantine, then a layman, to be proclaimed pope; and taking him to the Lateran palace, obliged the bishop of Palestrina to ordain him, and afterwards to consecrate him bishop. This usurpation produced great discontent at Rome, and various parties were formed, who elected two popes, of whom one was instantly thrown into prison, and the other as quickly deposed; after which there was a regular election, and the unanimous choice fell upon Ste-

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son of Charlemagne, and he sent legates into France, to pro-
poe an interview with that sovereign. Rheims was the
place fixed upon for that purpose; and Stephen repaired
thither, accompanied by Bernard, king of Italy. The em-
peror went to meet him upon his approach, and honoured
him by protestations and other tokens of profound reverence.
Stephen repaid his attentions, by solemnly crowning him
and his queen with rich crowns, which he had brought from
Italy. After palling two months in France, he returned to
Rome, where he died about seven months after his election.

Stephen VI. (V.), pope, whose original name was Basil,
was of a noble Roman family, a prebender of the church of
Rome, and highly venerated by all ranks, as well for the
purity of his morals as the sanctity of his life. He suc-
ceeded to the popedom in May, 885, upon the death of
Adrian III., and was forcibly carried for installation to the
Lateran, which ceremony was followed the next day by
his consecration. His election gave great offence to the em-
peror Charles the Grofs, who immediately sent a delegate to
depose the pope, as having been appointed without his con-
dent, or even knowledge; be was, however, pacified by a
solemn embassy bringing the decree of election, signed by
thirty bishops, and all the leading laycmen; and Stephen
was confirmed in his title. The eastern emperor, Basil the Ma-
cedonian, having formerly written a letter to the pope's pre-
decessor Adrian, severely reflecting upon him and the former
pope, Marinus, for refusing to communicate with the pa-
triarch of Constantinople, Photius; Stephen now wrote a
reply to the letter, defending the conduct of his predecess-
or, and strongly expressing his own disapprobation of
Photius. This patriarch being afterwards deposed by the em-
peror Leo the Philosopher, who placed his own brother
Stephen in the see, the pope was applied to by the eastern
bishops and clergy, requesting that he would grant a dis-
pensation for the new patriarch, who had been ordained
deacon by Photius, and would forgive those who had com-
unicated with Photius. The pope expressed much satisfac-
tion in the expulsion of Photius, but refused the dispensa-
tion till he could be more fully informed of the cause, for
which purpose he desired that bishops might be sent to him
from both parties. On the death of Charles the Grofs
without male heirs, in 886, there was a competition for the
succession to the crown of Italy, between Berenger, duke of
Friuli, and duke Bertrand of Spoleto; the eastern emperor,
Romans declared for the latter, who was eventually crowned
emperor by Stephen at Rome, in 891. This pope died
in the same year, after a pontificate of somewhat more than
six years.

Stephen VII. (VI.), pope, a native of Rome, placed on
the pontifical throne on the expulsion of Boniface, in
896, disgraced himself by the treatment which he bestowed
on the dead body of pope Formosus, who had preceded
Boniface. Having assembled a council for the purpose, he
cruelty it to be disinterred, and placed in its episcopal robes
in the papal chair. It was then asked, "Why didst thou
dare usurp the universal see of Rome?" No defence being
set up, Formosus was pronounced guilty of the charge of
intruding by unlawful means into the apostolical see; the
body was stripped of the pontifical ornaments, three of its
fingers were cut off, and it was thrown into the Tiber. At
the same time the council declared, that Formosus having
been incapable of confessing orders, all perfons who had re-
ceived them at his hands must be reordained. Stephen re-
verted the decree of Adrian III., which determined, that
a vacancy, the pope elect should be consecrated without
waiting for the presence of the imperial envoy. He en-
joyed his dignity only a very short time, for in 897 he was
dethroned, hurried into a dungeon, and there strangled.
Two letters to the archbishop of NARBONNE are attributed
to him, but probably without sufficient authority.

Stephen VIII. (VII.), pope, was also a native of
Rome, and elected successor to Leo VI. in the year 949;
he held the pontificate rather more than two years, and then
died, without having done any thing which has been deemed
worthy of record.

Stephen IX. (VIII.), pope, elected in 939, at the
vacancy made by the death of Leo VII., is said to have
been a German, and to have owed his election to the in-
fluence of the emperor Otto the Great. It is related of
this pontiff, that he sent the pallium to Hugh, archbishop
of Rheims, son of count Herbert, who had been expelled
from his see, and restored and consecrated by a council of
bishops, although at that time he was only eighteen years
of age; that he warmly espoused the cause of Lewis d'Out-
tremer against his rebellious subjects, sending a bishop into
France, with letters addressed to the nobles of that country
and Burgundy, in which he exhorted them to submit to their
lawful sovereigns, and then threatened them with excommu-
nication in case of disobedience. He also attempted to me-
date between Hugh, king of Italy, and Albert; and for
that purpose sent for Golo, abbot of Cluny, to Rome;
but both the abbot and he died very soon after, in the
year 943. He held the see of Rome three years and four
months.

Stephen X. (IX.), pope, whose former name was
Frederic, was brother to the duke of Lorraine. In the
time of Leo IX. being archdeacon of the church of Liége,
he was one of the delegates sent by that pontiff to the em-
peror Constatine XI., in order to negotiate a union between
the churches of Rome and Constantinople. On his return he
was created chancellor of the Roman church, and was made
abbot of the monastery at Monte Cassino. By pope
Victor II. he was raised to the dignity of cardinal, whom
he succeeded in the popedom. The election occurring on
the festival of St. Stephen, he assumed the name of that
saint. He immediately undertook the reform of the
clergy, and held councils, in which several canons were made
against marriage, and the concubinage of priests. He
exacted the submision of the church of Milan to that of
Rome, after it had for some years withdrawn itself from
that of Rome; and he held the pontifical chair only a few months.
Two letters of this pope are preferred, one to the archbishop
of Rheims, the other to the bishop of Marf.

Stephen, king of England, the son of Stephen, count
of Blois, by Adela, fourth daughter of William the Con-
queror, was born about 1104. He and his younger brother
Henry were invited over to England by the late king
Henry I., and were loaded with riches, honours, and high
preferments. Henry entered into the ecclesiastical profes-
sion, and was created abbot of Glastonbury, and bishop of
Winchester. But Stephen received higher marks of
favour, and more substantial establishments. He caused
him to be married to Matilda, the daughter and heirs of
Eudes, count of Boulogne, gave him the earldom of Mor-
tisgne.
STEPHEN.

taigue in Normandy, and the forfeited estates of Robert Mallet and others in England. Stephen, by his marriage, acquired a new connection with the royal family of England, as his wife's mother was sister to David, king of Scotland, and also to Matilda, the first wife of Henry, and mother of the emperors. Stephen, in return, professed the most grateful attachment to his uncle; and displayed a marked affection in taking the oath for securing the succession of the empress Matilda, daughter of Henry L., and lawful heir to the crown. In the mean time, however, he continued to cultivate, by every art of popularity, the friendship of the English nation; and the display of some virtues which he seemed to profess, favoured the success of his intentions. By his bravery, activity, and address, he acquired the esteem of the barons: By his generosity, and by his affable and amiable manner, not at all usual in that age among men of his high quality, he obtained the affections of the Londoners, and now entertained the most fanglour hopes, that by accumulating riches and power, and by acquiring popularity, he might in time make his way to the throne. As soon as Henry was dead, in 1135, he hastened from France to England, and was received in London with the loudest acclamations. But in order to obtain a formal coronation, it was necessary for him to gain the concurrence of the clergy; and for this purpose, his brother, the bishop of Winchester, was of material service. Roger, bishop of Salisbury, chief justiciary and regent of the kingdom, was readily brought over to his party; but the archbishop of Canterbury refused, till Hugh Bigod, steward of the household, made oath that the late king, upon his deathbed, had declared an intention of disinheriting his daughter Matilda, and leaving the crown to Stephen, although several of the nobility had been witnesses to a directly contrary declaration. Such was the necessity of the age, or the lax ideas of hereditary succession, that Stephen was solemnly crowned, and allowed to enter upon the exercise of the regal functions, though very few of the barons attended at his coronation. He made many concessions, promised to abdicate certain exactions and arbitrary measures of the reign since the Conquest, and engaged to restore the popular laws of Edward the Confessor. The first opponent of his government was David, king of Scotland, who, either to support the cause of his niece the empress, or to take advantage of the discontent of the faithful of the confraternity of an usurpation, entered the north of England with an army, and took possession of Carlisle and Newcastle. Stephen negotiated with him, and made large cessions as the price of peace. Robert, earl of Gloucester, natural son of Henry II., who was in Normandy when Stephen feigned the crown, fearing lest he should be deprived of his English estates, came over, and took an oath of fealty to the usurper, but under the condition that he should be obliged to keep it no longer than all the engagements made to himself should be complied with. Most of the other nobles, in submitting, stipulated for the right of fortifying their castles, which at length filled England with strong holds for rapine and every kind of disorder.

The success of Stephen was, at first, equally flattering in Normandy. He was invited over to assume the sovereignty of that duchy, and in 1137 he accepted the invitation, and formed an alliance with the king of France. The king of Scotland made a second incursion into England, on the pretext of occupying Northumberland, upon which province his son Henry had a claim; and his demands being rejected, he cruelly laid the country waste with fire and sword. Stephen marched to oppose him, but was recalled by disturbances in the south. The northern barons, provoked at the success of the Scottish arms, raised an army, with which they encountered David at Northallerton, and gave him an entire defeat in the battle of the Standard. Stephen, in the mean time, had involved himself in a dangerous contest with the ecclesiastical power. The bishop of Salisbury, his two nephews, the bishops of Lincoln and Ely, and his natural son, the chancellor of England, had erected strong castles, which they held in defiance of the regal authority. Stephen having called, in 1139, a council of the nobility at Oxford, feigned the bishops of Salisbury and Lincoln, and the chancellor, and in a short time made himself master of the other castles. These violent proceedings caused the assembling of a synod at Westminster, by the bishop of Winchester, Stephen's brother, and legate of the holy see, who felt more for the privileges of his order than the ties of blood. The synod sent a summons to Stephen, who delegated a nobleman to appear for him, and an open breach was prevented only by the firmness of some barons, who regarded the conduct of the bishops as f egitious and unbecoming their character. Discontents were, however, aggrava-

...
ter prince should, on the demise of Stephen, succeed to the kingdom, and to William, Stephen’s son, to Boulogne, and his patrimonial estate. After all the barons had sworn to the observance of this treaty, and done homage to Henry, as to the heir of the crown, that prince evacuated the kingdom; and the death of Stephen, which happened in the next year, after a short illness, prevented all those quarrels and jealousies which were likely to have ensued in so delicate a situation.

“England,” says Mr. Hume, “suffered great miseries during the reign of this prince: but his personal character, allowing for the temerity and injustice of his usurpation, appears not liable to any great exceptions; and he seems to have been well qualified, had he succeeded by a just title, to have promoted the happiness and prosperity of his subjects. He was possessed of industry, activity, and courage, to a great degree; though not endowed with a sound judgment, he was not deficient in abilities; he had the talent of gaining men’s affections; and notwithstanding his precarious situation, he never indulged himself in the exercise of any cruelty and revenge. His advancement to the throne procured him neither tranquility nor happiness; and though the situation of England presented him with many advantages from taking any durable advantage of her confusion, her intellectual disorders were to the last degree ruinous and destructive. The court of Rome was also permitted, during those civil wars, to make farther advances in her usurpations; and appeals to the pope, which had always been strictly prohibited by the English laws, became now common in every ecclesiastical controversy.” Hume. Henry.

Stephen I, king of Hungary, called Saint Stephen, succeeded to the throne in 997, on the death of his father Géza. He was then very young, but had been declared king by the States in the preceding year, which title he is said to have been the first who bore in Hungary. He is celebrated for his piety, which he displayed by his great zeal in the conversion of his heathen subjects. The nobles, adhering strongly to their ancient religion, raised a rebellion against him, headed by the duke of Cusa: their leader was slain, and themselves completely routed. The body of Cusa was divided into four parts, and exposed in four of the principal cities of Hungary. After this great victory, he established twelve bishoprics, richly endowed, and built many churches; and was so devout, as to erect a church at Constantinople, another at Rome, and a monastery at Jerusalem. In the year 1002, Giala, prince of Transylvania, Stephen’s uncle, making an irruption into the adjacent provinces, Stephen marched against him, and in a few months made himself master of Transylvania, which he annexed to the crown. He afterwards repelled an invasion of the Bulgarians, purged them to their own country, and obtaining a signal victory, returned laden with booty. Besides the glory derived from his success in war, he had that of being the legislator of his country. He published a code composed in fifty-five chapters, which, though marked with the barbarism and ignorance of the times, was very long popular among the Hungarians. Towards the end of his reign, it was his intention to reign his crown to his son, in order that he might pass the remainder of his days in a religious retreat, but the premature death of the prince disconcerted this design. He died at Buda in 1034, and was canonized at Rome. His memory is held in profound reverence by the Hungarians, who have preferred the crown sent to him by the pope as the palladium of their kingdom.

Stephen, John, in the Latin tongue Stephanus, a learned Dane, was born at Copenhagen in 1599. He studied at the schol of Herlesholm, and after having twice travelled into foreign countries, was made professor of eloquence at Soroe, in 1650. In 1659 he became professor of history in the same university, and was afterwards appointed to be historiographer by Christian IV. He died in 1670. Among his works are enumerated the following: “Breves Emendationes et Notae in Saxonom Grammaticum,” 1627. “Florilegium Sententiarius ex Saxone,” 1627. “De regno Daniae et Norvagiae, Inulis adjacentibus Translatus varius,” 1629. “Suenonis Agonias Fili Opificula, Notis illustrata, accedunt Leges Castrimenses Canuti magni, et incerti Auctoris Genealogia Regum Daniae,” 1642. “Historia Danicae Libri duo, qui complectuntur res memoratoris dignae, in Dania gestatas, Regnante Christiano III., ab Anno 1550, ad Annum 1550.”

Stevens, in Geography, a river of Vermont, which runs into the Connecticut.

Stevens, Cape, a point of the American continent, opposite to Stuart’s island, situated in N. lat. 63° 33', and E. long. 197° 41'.

Stevens’s Passage, a strait between Admiralty Island, and the continent of America; the outlet is between Point Wincham, from whence it extends about 70 miles north, a little inclining to the west. N. lat. 59° 30'. E. long. 216° 35'.

Stevens’s Island, an island in the North Pacific ocean, about 24 miles in circumference, situated to the north of Pitt’s Archipelago. N. lat. 54° 11'. E. long. 220° 30'.

Stevens’s Island, a small island in the N.W. part of Cook’s Straits, in New Zealand. N. lat. 40° 39'. W. long. 183° 6'.

Stevens’s Islands, two small islands in the Eastern-Indian seas, discovered by captain Carteret in 1767. They had a green pleasant appearance, and were well covered with trees; but whether they were inhabited he did not know. They run about N.W. by W., and S.E. by E.; one is about three miles long, and the other about six. The passage between them appeared to be about two miles broad. S. lat. 60° 22'. E. long. 138° 39'. Hawkeforth’s Voyages, vol. ii. p. 587.

Stevens, Pont, a low rocky point on the coast of New Holland, New South Wales, on the N. side of which is an inlet, called “Port Stephens,” sheltered from all winds, lying in S. lat. 32° 40'. W. long. 20° 51'. At the entrance are three small islands, two of which are high; and on the main, near the shore, are some high round hills, which at a distance appear like islands.

Stevens’s Medicine for the Stone. Mrs. Stevens having sold medicines for the stone in the bladder, or kidney, Dr. Hartley published several cases of their success; and so much was paid of them, that the parliament appointed trustees to examine into the truth of what was alleged in their favour. The report of these trustees being favourable, she had 5000l. hering ordered her, in 1739, for publishing the receipt.

Her medicines are a powder, a decoction, and pills. The powder is fixed parts of fine powder of hen-egg shell, calcined until they become of a greyish-white colour, and of an acid salt taffe, then left two months in an open vessel, to be sufficiently calcined falls into a fine powder, through a current from the groffer parts by paining. To this egg-shell lime add one-sixth part of the powder of finalls, with that burnt in a crucible, till powder of finalls is to be they have smocking. A draught of this powder is to be drank after each dose. If the patient feels pain, is
to be made milder by opiates; if he is acute, gentle laxatives are to be taken, and purging is to be restrained: if the powder is too strong in the above proportion of five parts of the powder of egg-yells to one of snail-powder, it is to be weakened by increasing the proportion of the snail-powder.

To make the decoction, the prepared balls composed of four ounces and a half of the balm Alicant soap, a large spoonful of the powder of asphaltum, burnt to blacknesse, and as much honey as was necessary. She boiled one of these balls laced with cut green chamomile, or chamomile flowers, sweet fennel, parsley, and burdock-leaves, of each one ounce, in two quarts of water, half an hour, then strained it off, and sweetened it with honey. When these herbs are not to be had green, she takes the same quantity of their roots, cut and sliced. These whole stomachs cannot bear this decoction, may take one-fifth part of the ball formed into pills, with every dose of the powder.

The pills are made by taking equal quantities, by measure, of snails calcined as before, of wild carrot-seeds, burdock-seeds, athen-keys, hips and haws, all burnt to blacknesse, and reduced to a fine powder; with a large spoonful of this powder, four ounces of soap, and as much honey as is necessary, bring them to the consistence of pills, of which sixty are to be formed out of every ounce of the composition. In fits of the gravel, five of these pills are taken every hour awake, till the complaints are removed.

During the use of these medicines, the patient ought to abstain from fats, meats, red wines, and milk, drink few liquors, and use little exercise.

Dr. Hartley, leaving out the superfluous part of Mrs. Stephens's prescription, reduces her receipt to a more simple form; for an account of which, see Lithnontriptic.

Dr. Hales, after several trials on the different ingredients, found that the diffusing power of these lay in the lime, which Dr. Rutty confirmed; and Dr. Jurin having taken soap-leaves, the ingredients of which are pot-ash and lime, beginning with a few drops, and increasing the quantity till he took an ounce, or an ounce and a half every day, in a proper vehicle, was cured of bloody urine, pain, &c. and passed several small stones; after which he had no uneasiness.


For other forms of administering soap and lime, and remarks on Mrs. Stephens's medicine, see Lithnontriptic. See also Limes-Water.

STEPHENTOWN, in Geography, a township of America, in the state of New York, situated in the south-east corner of Renfleuer county; 24 miles S.E. from Troy; bounded N. by Berlin, E. by the state of Massachusetts, S. by Canaan in the county of Columbia, and W. by Nafa. This township is hilly, and has a diversity of soil. Its hills in some parts rise to mountains. The central part, between the ridges of the mountains, principally on the east and west, is occupied by an extensive valley, in which rises a fine branch of Lebanon creek, or by hills of a moderate height, and is arable and productive. In the west part, called the Green woods, there are extensive forests of pine, and the soil is of little value. The vale of Stephentown opens northward from that of New Lebanon, in Canaan, and is a very pleasant tract of light timbered gravel. This township affords limewall, and excellent slate for the roofing of houses. The whole population, in 1810, consisted of 2,567 persons, with 257 senatorial electors.

STEPNAIA, a forteress of Russia, in the government of Ufa; 24 miles W. of Troitsk.

STEPNEY, in Geography, an English poet, and political negotiator, was defended from the Steppney of Pendegraft, in the county of Pembroke, and was born at Westminster in 1663. He received the early part of his education at Westminster school, whence he was removed, in 1682, to Trinity college, Cambridge. He made himself known as an academic poet by a Latin ode on the marriage of the princes Anne to George, prince of Denmark, printed with the other Cambridge verses on that occasion. These were followed by a short copy of English verses on the accession of James II. The friendship which he had contrapled at school with Charles Montague, afterwards earl of Halifax, engaged him with the Whig party after the revolution, and brought him into public employments, in which he chiefly spent his life. He was sent envoy to the elector of Brandenburg, in 1692; to the imperial court, in 1693; to the elector of Saxony, in 1694; to the king of Poland, in 1699; again to the emperor, in 1702; and to the States-general, in 1706. As a reward for his services, he was made one of the commissioners of trade in 1697. He died at Cheles in 1707, and his remains are honourably interred in Westminster-Abbey, where a monument was erected to his memory. The poems of this author were composed at an early age. He published some political tracts, three of which are printed in lord Somers's Collection.

STEPNEY, or Stobunbhs, in Geography, a large and populous parish in the hundred of Offulton, and county of Middlesex, England, may be regarded as a suburb of London, as it is connected with the eastern side of that metropolis. This parish now comprises the hamlets of Mile-End, Ratcliffe, and Poplar and Blackwall; the whole of which contained in 1811, 6,116 houses and 35,199 inhabitants.

The origin of the name of Stepney is very doubtful, but is supposed to have been derived from the Saxon steb-hyche, a timber-wharf; or from Stiben, a corruption of Stephen. It is bounded by the parishes of Bromley, Stratford-Bow, Hackney, Bethnal-Green, Spitalfields, St. George in the East, and Shadwell; all of which, about a century since, were parts of the parish of Stepney. In the year 1794 it contained, as Mr. Lysons remarks, "about 3,510 acres of land, (exclusive of the site of buildings,) of which about 80 were then arable, about 50 occupied by market gardeners, and the remainder meadow, pasture, and marthy land." But since that year, the increase of buildings has produced a considerable diminution in the ground appropriated to agricultural and horticultural purposes.

In 1595, Edward I. held a parliament here, in the house of Henry Walleis, lord mayor of London, and gave his confirmation to the great charter. The manor of this place was formerly polluted by the bishops of London; and Roger Niger is thought to have died at the monastical residence in 1241. It passed, however, from that fee to king Edward VI. by gift from the ill-fated Ridley; and after having been granted to lord Wentworth, detecended through him to Thomas, earl of Cleveland; by whose influence with the king it was endowed with a court of record, a weekly market at Ratcliffe-Croif, and an annual fair on Michaelmas day. Stepney manor is now vested in the family of Colebrook. Exclusive of this the principal manor, the Domef-day Survey states that the parish of Stepney contained several smaller ones: all these were held, with the exception of two, of the bishop of London, and were entitled Stepney-Hulkars, Pomfret, Lord Wake's, Helles, Poplar, Cobham, Mile-End, Ewell, and Rumbolds. In 1567, a water-course, which had formerly belonged to the convent of Friars-Minors, was granted to William, marquis of Winchester, with
with liberty to conduct its firearms to his mansion-house in London.

Almost opposite the present rectory-house, Henry, first marquis of Worcester, poissified a large mansion in 1663, of which the buildings are devoted to the family of Mead; and in this dwelling Dr. Richard Mead was born, and first commenced the practice of his profession. The church, dedicated to St. Dunstan and All Saints, is large, and consists of a chancel, nave, and two aisles, separated by columns and pointed arches. At the west end is a square tower. Tombs of several illustrious characters are to be found in this place, especially those of Sir Henry Colet, lord mayor in 1486 and 1495, the father of Dr. John Colet, who founded St. Paul's school; Sir John Berry, a distinguished officer in the reign of Edward II., by whom he was knighted; Jane Nevill, lady Dethick; and Sir Thomas Spert, comptroller of the navy to Henry VIII., and founder of the Trinity-house. The font stands on a circular pillar, surrounded by four others of a smaller size. On the south side of the church are sculptures of the crucifixion, and of a figure in the posture of adoration before the Virgin and the infant Saviour. The wall of a porch towards the north-east contains a stone, on which verses dated 1663, flate to have been brought from Carthage. The church contains, with many other celebrated names, those of Dr. Richard Mead, and his father. A short distance from the west of this edifice is an ancient wooden mansion, built, it is supposed, in 1534, by Sir Henry Colet, and leased to Thomas, earl of Essex. It is now considerably altered, divided into several small tenements, and its name changed from the Great Place to Spring Garden coffee-house. Another of these relics of antiquity stands on Mile-End Green, and is now let in separate apartments. This latter, with some other contiguous habitations, are held under Clare-hall, Cambridge. The brick wall, which enclosed the site of the ancient rectory, still remains. Sir John Colet, before mentioned, who was vicar of Stepney, lived at the north end of White-Horse Street, Ratcliffe. Some time after his resignation, it was received by Dr. Pace, who died here in 1532, and was buried in Stepney church. This parish likewise contains several dissenting and Methodist meeting-houses: these are Sion-chapel, a chapel belonging to the Society of Friends in Brook Street, Ratcliffe, one of Mr. Whitfield's at Mile-End, that formerly occupied by Mr. Brewer, and some others of recent erection.

Poplar and several other charitable subscriptions, belonging to public bodies, are also situated on this road, viz. the Trinity alms-houses, founded by that corporation in 1605; Bancroft's hospital, founded in 1727; the Pinners' alms-houses, built in 1628; and the vintners', and three others, for the benefit of the whole parish collectively. A lazard-house existed here in the 16th century.

In this hamlet is Brewer's meeting-house, (now Ford's,) and a Methodist chapel. On the north side of the road are two Judaic cemeteries, entitled "The house of the living," where the dead are interred in rows, divided into certain spaces; and no grave is ever opened a second time. There is also a hospital built in 1793, and an adjoining alms-house near the same spot.

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southern part, consist chiefly of the pinus sylvestris, fir, and birch; and on the elevation beautiful larches. On this level are several lakes and rivers.

The steppe of the Dnieper comprehends a large plain, which lies in the government of Ekaterinoslaff, between the Dnieper and the Bogue; the Crimean steppe on the left side of the Dnieper, and the whole space which extends over the Donetz, as far as the Don, and the sea of Azof, and the Euxine. This extensive steppe, comprehending the greater part of the governments of Ekaterinoslaff, Taurida, and a part of Voroneth, Korkhof, and Kief, is in general of a very dry and sandy quality, and contains many salt-lakes and salt-plots, but is little inhabited.

The steppe of the Volga and Volga comprises the whole space between the Don, the Volga, and the Kuban, and is a large, very arid steppe, altogether defitute of wood and water; it has few inhabitants, and contains several salt-lakes and salt-plots. It spreads through the greater part of the government of Caucasus, and into those of Ekaterinoslaff and Saratoff, where, in its sandy and calciferous mountains, it contains coals, sulphur-pyrites, and warm baths. Within the confines of this steppe lies what is called the Kuman steppe, comprehending the whole space from this steppe to the spot where the Kuma flows out of the mountains, and reaches southward to the banks of the Terek and the Caffian seas, northward to the other side of the Sarpa, and eastward as far as the Volga. In this steppe the salt-lakes of Altrakan, some bitter lakes, warm springs, &c. This steppe, it is said, has all the appearance of a dried-up sea: it is a sandy, part clayey and salt plain, without trees. Many circumstances render it probable that it might really have been sea-bottom, as the flat shores of the Caffian and Azof seas, and the shalows of their coasts, the low situation of the steppe, the saline lakes, and the sea-shells, &c.

The steppe of the Volga and Ural is extensive, and comprehends, between the rivers Volga and Ural, that whole flat country which formerly bore the name of the Kalmyk steppe, and between the Ural and the Yeniza, a part of the Kirghizii steppe lying within the Russian borders. The above-mentioned steppe is called the Kalmyk steppe, because it was left in possession of a horde of that nation, by whom it was inhabited till the time of their flight in 1771. It consists of a far-stretching ridge of sand-mountains, called Narym, and is said to be between 50 and 150 versts in breadth, extending from the Ural mountains, through the middle of the steppe, quite to the Caffian sea. The soil consists of sand, marie, and clay, often mixed with sea-shells, which indicate this to have been, like the Kuman steppe already mentioned, the bottom of the sea. But to return to the steppe of the Volga and Ural. This to the south makes the margin of the Caffian sea, and to the north it skirts the foot mountains that run out from the Ural chain. This plain, for the most part sandy, is very deficient in fresh water and wood; but so much the richer in rock-felt, and salt-lakes that are very productive. It contains many districts well adapted to the purposes of agriculture and the breeding of cattle; but is very poorly inhabited. One part of it lies in the Caucasian, and the other in the Ufimskian government.

The steppe of the Irtysh denotes that large plain which extends between the Tobol and the Irtysh, and between the latter and the Alay and Oby, as far as the influx of the Irtysh into the Oby, including an enormous territory. It abounds with lakes of several kinds of falls, among numerous forests of pines, fir, and birch, and is in most places well suited to pasturage and agriculture; but, in proportion to its extent, very thinly peopled. Between the Irtysh and the Oby, this plain incloses all that fine well-watered level called the Barabinian steppe, on which are seen many considerable lakes; extending in length from north to south above 600 versts, and in breadth 400 from west to east. Its plain has generally a good black soil, enlivened on its surface by many pleasant forests of birch: hence it has been concluded, that the Barabs must have been one general bed of waters, and far more morass and abounding with lakes than at present. Another part of the large plain constituting the steppe of the Irtysh, between the Ichiham and the Irtysh, is called the Ichim steppe, and is found to abound in bitter lakes, but in other respects resembling the Barabinian steppe, in both which many ancient tombs occur. The greatest part of the whole steppe of the Irtysh lies in the government of Tobolisk, but the other part in that of Kolhyan.

The steppe of the Oby and Yenissei includes the whole of that large tract between the Tobol and the Tubul (which falls into the Oby), between the Oby and the Yenissei, and extends to the shores of the Frozen ocean. The best forests are found towards the south; on the northernmost margin of the Frozen ocean the wood is low and short. The whole of this steppe lies in the government of Tobolisk.

The steppe of the Yenissei and Lena is a large tract of desert, bounded by the Yenissei, the Tungulka, and the Lena; reaching northward, like the former, to the Frozen ocean, and reembling in it nature and quality. One part lies in the government of Tobolisk, and the rest in that of Irkutsk.

The steppe of the Lena and Indighirka is a vast extended plain along the shores of the Frozen ocean, between the Lena and the Koymsa, to the two sides of the Indighirka, and is wholly in the government of Irkutsk. Tooke's Russ. Emp. vol. 1.

STERA, in Anatomy, a word used by some of the barbarous writers to express the uterus. It seems to have been only a corruption of the word hyfera.

STERANG, in Geography, a town of Norway, in the province of Angerhausen; 13 miles N.N.W. of Christiania.


Gen. Ch. Cal. Perianth inferior, of three or five, roundish, concave, acute leaves. Cor. Petals three or five, roundish, notched, ungulate, longer than the calyx. Stem. Filaments numerous, capillary, inserted into the receptacle; anthers roundish. Gif. German superior, ovate; style long, incurved at the tip; stigma capitate, concave. Pet. Ligneum ciliolatum, long, corticifo, fleshy, one-celled, not bursting. Seed numerous, large, angulate, incumbent on each other, imbedded in the pulp.

Eff. Ch. Calyx of three or five leaves. Petals three or five. Ligneum corticifo, not bursting. Seeds numerous, imbricated, imbedded in the pulp.

1. S. laterifera. Wild. n. 1. (Singara guianensis; Aubl. Guian. t. 250.)—Native of woods in Guiana, where it flowers, and bears fruit in September. —This fœnum is remarkable for throwing out numerous, knotted, creeping roots or fœna, which run in a scattered manner over other trees, and are much branched. Leaves nearly opposite, stalked, ovate, acute, smooth, entire. Flowers corymbose, scattered,
STERCORARIANS, or STERCORARIUM, formed from fuscus, dung, a name which tho' of the Roman church recently gave to such as held that the host was liable to digitation, and all its consequences, like other food.

STERCORARIUM Pluvis, the dung-fish, in Ichthyology, the name of an East Indian fish; so called from its frequenting necessary-houses which are over the water, and other places where the like naughtiness is to be found. It is, for this reason, supposed unwholesome by some, but is really a very well-talked fish, and eaten by most people where it is to be had. It is a broad and thin fish, of about six or seven inches long, and nearly as much in breadth. Its back is variegated with spots of deep brown; its belly is bluish.

STERCORARY, in Agriculture, a place properly secured from the weather for containing dung. In collecting manures from time to time, as they come to hand, farmers generally keep them together and then they call dung-hillcs, where they remain exposed to the heat of the sun, the washing of rain, and the drying winds; by which means a great deal of their virtue is dissipated and lost. The making of ferces has, therefore, been advised, which may be done by digging a square or oblong pit, of the size suited to the quantity of the compost wanted, or proportioned to the extent of the ground intended to be manured; the fide next the field or place where taken away being made flowering, so as to receive a cart to load or unload easily. The bottom should be well paved, and both the fides lined with pure clay, (unless it be made in a bed of clay or chalk,) that it may be capable of retaining water like a cistern; as it is of great importance for the dung to have a proper degree of moisture. And where channels or gutters can be directed to the pit, from the fides and other offices about the house, they will be of great service. Some think that they should be covered, so as at least to hinder rains from falling upon them; but if care be taken to make the pit in a place where no running water or springs can come to it, and if the farmer covers the dung, as it is collected, with a coat of mould, to prevent the fun's exhaustion or the rains washing away its richness, the quantity of water which falls in rain may not be more than requisite to moisten the mixture, and bring on that putrid fermentation which is necessary for the due incorporating and perfecting of the compost. It will, however, be right to have a shed to put over it occasionally, in case the leaflon should prove extremely wet. It has been observed by Columella, that the Romans covered their ferces with hurdles; but he does not speak of covering them with mould, in the manner mentioned above. See COMPOST, FARM-YARD, and MANURE.


Gen. Ch. Cal. Perianth inferior, of one large, coloured, rather coriaceous leaf, deciduous; somewhat turbinate at the base; its limb in five deep, pointed segments. Cor. six. Ovul. of imbrication elevated on a cylindrical and curved column, various in length, but always much shorter than the calyx. Stam. Filaments scarcely any; anthers from ten to fifteen, clustered, inserted into the notched margin of the top of the column, roundish, of two distinct lobes. Fil. Germ. sessile above the anthers, roundish, of five lobes; style vertical, deflexed, cylindrical, not half the length of the column; stigma obtuse, notched. Petals five, spreading, ovate, oblong, large, coriaceous, or woody, furling along the upper side. Seeds several, oval, attached to each margin of the follicle.

St. Ch. Calyx in five deep segments. Corolla none. Germen and anthers elevated on a column. Follicles five, with many seeds.

Obst. Many of the flowers, on the same or a different plant, have no pistil. In those with a pistil, the anthers are sometimes, but not always, imperfect. Several of the follicles in each flower, as well as many seeds in each follicle, are liable to prove abortive, at least in gardens. The margin of the column is scarcely discernible in some species, nor is it, in any, conspicuous enough to be taken for the filament of the flower. We would therefore not concur with Schreber and Willdenow in the classification of this genus. The style is sometimes divided down to the base into five parts.

1. S. lanceolata. Lanceolate Chinefe Sterculia. Cavan. Diff. n. 416. t. 142. f. 1. Willd. n. 1. Lamarck n. 2. — "Leaves lanceolate. Follicles oblong."—Native of China. A very uncertain species, adopted by Cavanilles from a Chinese drawing, in which the stems were represented about one inch and a half long, and half an inch broad; the follicles about the same length, narrow, crimson, with three or four black seeds in each. If such be the natural figure of the parts, the plant is different from any other known Sterculia. A familiar representation, however, of various dimensions, is common on Chinese papers, and we suspect it may, in every instance, be meant for a species hereafter described by the name of nobilis.

2. S. Balangbas. Balanghas Sterculia. Linn. Sp. Pl. 1430. Willd. n. 2. (S. foliis ovalibus integerrimis alternis petiolatis, floribus paniculatis; Linn. Zeyl. 165. Cydonia arbor, Balanghas dicta; Burm. Zeyl. 84. Nux reginae zeylanica minor bifida, flore purpureum; ibid. 170. Nawaghass; Herb. Zeyl. 25. Telabo; Syen in Rheede Hort. Malab. v. 1. 90, note!)—Leaves exactly elliptical, with a small point; very slightly downy beneath. Panicles much shorter than the leaves. Calyx hairy on both sides; densely fringed at the margin.—Native of Ceylon. The stem is arborescent, with round, smooth, pale branches, leafy at the end. Leaves alternate, filiform, five or six inches long; and two and a half or three broad, very exactly oval, rather coriaceous, entire, as in the whole genus, tipped with a small blunted point, scarcely half an inch in length; furnished with one longitudinal, and many transverse, ribs, all pale and smooth, connected by innumerable minute reticulations; their upper surface bright green, shining, and smooth; under very little paler, forfith to the touch, from scarcely discernible hair down. Footstalks smooth, an inch or more in length, with a fort of joint at the summit. Panicles axillary, about the ends of the branches, many-flowered, twice as long as the footstalks; their branches alternate, thread-shaped, green, hairy. Flowers solitary at the end of each partial stalk, small, said to be very fetid. Base of the calyx cup-shaped, smooth within; segments of its limb converging, and connected by their points, hairy on both sides, and particularly hispid at the edges, resembling, in the dried specimens, purple velvet or fluff. A specimen of this, communicated by Thunberg to Linnaeus, and marked Sterculia Balanghas, seems to be the
STERCULIA.

The real plant described with "oval leaves" in the Flora Zeylanica, from Herbart's herbarium. But in writing the Species Plantarum, Linnaeus uses the term "ovate," from a view probably of the figures, which he considered as belonging to this species, not having then a specimen before him. What those figures represent, we shall endeavour to ascertain hereafter. We have been the more precise in describing what we take for the genuine Balangbars, because no recent author seems acquainted with this plant; though its name, in every body's mouth, is applied to several very different from it and from each other.

3. S. rubiginosa. Rufty Sterculia. Veneta. Malmaif. sub fol. 91. Laminec. n. 4. (S. Ballanghas; Wild. n. 26.) Cavan. Diff. n. 415. t. 144, 111. Bad. Cavala; Rheeide Hort. Malab. v. i. 89. t. 49. Nux malabarica fulcata mucilaginosa fabacea; Pluck. Almag. 265.)—Leaves elliptic-oblong, taper-pointed, plant; downy and rufty beneath. Panicles much longer than the leaves. Calyx hairy on both sides, fringed at the margin.—Native of Malabar, Chittagong, Java, and perhaps of Africa, near Sierra Leone. A tall tree, with copious spreading branches. Rheeide. The young branches, clothed with rufty down, are leafy and copiously flowery at their extremities. Leaves from three to five inches long, (on downy rufty flarks about an inch in length,) plant, not rigid or coriaceous; rounded at the base, though gradually contracted towards that part; dilated upwards to the breadth of one and a half or two inches; then tapering into a point; entire, though somewhat wavy, at the margin; furnished with one longitudinal rib and many transverse ones, connected by reticulations; the upper side green, shining, nearly or quite smooth; under paler, opaque, soft with rufty hairy down, which is very copious on the ribs and veins. Panicles numerous, axillary, nearly twice as long as the leaves, alternately and repeatedly branched, spreading, with slender, downy rufty flarks, and scattered, lanceolate, downy, deciduous bracteas. Tube of the calyx short, shallow, nearly hemispherical, very hairy externally, rough within; limb three to long, converging as in the last, most hairy at the edges, well compared by Rheeide to red violet, which has a texture of the dried flowers, though the colour is browner, or more faded, than in our S. Balangbars. Follicles resembing those of a Peony, two inches and a half long, coriaceous, pointed; finely downy and rufty at the outside; smooth, reddish, and wrinkled, internally. Such is the plant sent by Dr. Buchanan from Chittagong, exactly agreeing with Commerfon's Java specimem, in fruit, and not less accurately with the plant of Rheeide; whose figure, we must observe, is copied, or rather perverted, by Cavanilles. What was raised from Sierra Leone seeds, in lady Amelia Hume's hothouse, appears by the leaves to be our rubiginosa, though their pubescence is less copious and less rufty than in dried specimens. Their texture is plain, not coriaceous. This may however be a distinct species. The seeds of the present, as well as the foregoing, are much eaten, like our chufnuts, in India. They seem, by Pluknet's synonymy, to be the real Malabar Nut; a name which, by some accident, has been vulgarly applied to Justicia Adhatoda. Perhaps a similarity between the leaves of the two plants, raised from seed, may have led gardeners into this error.

3. S. arcuolata. Pitcher-flowered Sterculia, or Wild Chocolate. (Clompanus minor; Rumph. Amboin. v. 3. 169. t. 107.)—Leaves elliptic-oblong, acute, plant; pale and finely downy beneath. Panicles close, hardly longer than the footstalks. Calyx pitcher-shaped, hairy all over.—Sent, in 1797, by Mr. Christopher Smith, from the island of Honimos, near Amboyna, where it is called Wild Chocolate; but whether from the resemblance of its seeds to those of real chocolate in shape, or from their being roasted and used as such, we know not. We conceive Rumphius's synonymy, hitherto misapplied to the Balangbars, must belong to this species. Our specimens are distinguished by the longer proportion of their footstalks, which sometimes measure more than two inches. The leaves, though shaped like the lalt, are pale at the back, being very minutely downy with whitish, not rufty, hairy hairs. The flowers are much fewer in each panicle, and more crowded, the hairs of the flarks, calyx, and especially the margin of the latter, being hoary or white, not red or rufty. Bracteas ovato-lanceolate, with long points. Tube of the calyx pitcher-shaped, constricted at the mouth, and nearly as long as the limb. We have seen no fruit. Rumphius describes its plant with whitish flowers, whose scent is oppressive, but not lalting; the fruit of a fine crimson.

4. S. nobilis. Great Chinese Sterculia. (S. Ballanghas; Adn. n. 1. S. monopetra; Veneta. Malmaif. t. 91. Laminec. n. 3. Southwellia nobilis; Salt. Parad. t. 69, excluding all the synonyms, except Veneta.)—Leaves elliptical, obtuse, with a small point, coriaceous, very smooth and shining on both sides. Panicles spreading, longer than the leaves. Calyx somewhat hairy.—Supposed to be a native of China, from whence it was imported in 1787, by lady Amelia Hume, and flowered in her hothouse for the first time in England, in the spring of 1789. By her ladyship's liberality it was quickly dispersed among the collections of this country, and found its way into France, being easily raised from seeds, which are ripened in the etove or conservatory. The stem is arborescent, of quick growth, round, with many smooth branches. Leaves from four or five inches to a foot, or more, in length, three or four inches in breadth, when full grown very smooth, and copiously reticulated, of a rigid or coriaceous texture. Footstalks smooth, stout, above an inch long. Panicles drooping, very large, and copious, repeatedly subdivided; their flarks pale, slender, downy and rather vilid, very tender. Flowers drooping, of the same pale buff hue as their flarks. Tube of the calyx bell-shaped, nearly smooth, limb downy, and sparingly hairy, with converging combined points. Anthers yellow. German red. Follicles two inches long, crimson within. Seeds blue-violet, three or four in each follicle, it having been merely from partial abortion that Ventenat's plant bore solitary seed. This fruit is sometimes seen delineated on Chinese papers, along with others in common use. Nothing can afford a more striking appearance than this tree in a hot-house, whether in April, when covered with flowers, or in the latter part of summer, when laden with its large black seeds, standing on the edges of the red and brown seed-veils. It is cultivated in the botanical garden at Calcutta, by the name of S. Balangbars.

5. S. longifolia. Long-leaved Sterculia. Veneta. Malmaif. sub fol. 91. Laminec. n. 13.—"Leaves ovato-oblong, smooth, segments of the calyx erect, internally hairy."—Native of Java. La Haie. The branches are said to be smooth. Leaves resembling S. rubiginosa in shape, but perfectly smooth on both sides, plant, pointed, six to eight inches long, at least two broad, with whitish ribs. Footstalks slender, smooth, an inch long. Flowers small, in spreading terminal panicles, whose branches are smooth and very slender. Calyx bell-shaped, slightly pubescent; its segments downy and whitish on the inner side. Such is Poiret's description, in Lamark, from a dried specimen.

STERCULIA.

Inum very short. Styles five, reflexed. — Native of the Mauritius, Comorin. Branches round, dark brown, smooth and polished, leafy at the summit. Leaves fix or eight inches, or more, in length, four at leaf in breadth, coriaceous, with a long point, smooth and shining, strongly veined. Footstalks thick, two inches long. Panicles large and spreading, somewhat cymose, with thick, compressed, very smooth branches. Calyx large, with five, widely spreading, smooth, lanceolate, coloured segments. German nearly sericeous, armed with five reflexed styles or ligulas, which cause a doubt concerning the genus of this species. 

Poirier.


Calyx very short. Native of the coast of Africa, from whence we have a specimen in flower, gathered by Dr. Afzelius. The branches of this tree are round and smooth, leafy at the ends. Leaves imperfectly opposite, three or four inches long, one and a half or two inches broad, strongly veined, firm; rufous, though quite smooth, beneath. Footstalks an inch or inch and half long, smooth. Panicles lateral, below the leaves, solitary, forked, dense, of about ten or twelve large flowers, their filaments, as well as the outside of the calyx, rough with dense flaky hairs, or rather a form of deciduous malacine. Calyx spreading, an inch broad, in five, sometimes six, broad, ovate, obtuse segments; smooth and coloured within. Columns scarcely any. German rough, five-lobed. Stigmas five, reflexed. We do not find the calyx has more than five divisions; Poirier describes fix. The filaments are said to be five, with solitary reddish seeds. The five ligulas, or styles, agree with the leaf. Probably this character, and the nearly sericeous leaves, to say nothing of the spreading calyx, may indicate a generic difference. The seeds of this species, known by the name of Cola, have long been celebrated by voyagers, as possessing a high degree of value among the natives of the Guinea coast, who are reported to take a portion of one of them to enhance the flavour of any thing they may subsequently eat or drink. Dr. Afzelius found these seeds in high estimation at Sierra Leone, and was not a little pleased to procure specimens of the plant, though he had no idea of its genus. If we mistake it, he brought it alive to this country, but it has not lately been heard of.

8. S. nitida. Shining Sterculia. Venten. Malm. sub fol. 91. Lamark n. 17. — "Leaves lanceolate-oblong, pointed. Segments of the calyx spreading, Cola, scarcely any." — Native of Africa cultivated in the island of Mauritius. Ventenat supposed the flowers to be dioecious. This may possibly be different from the last species, but we have not sufficient information to form an opinion on the subject.

9. S. crinata. Hairy-fruited Sterculia. Cavan. Diff. n. 413. t. 142. Wild. n. 3. Lamark n. 5. Ait. n. 2. (S. Iria; Swartz Ind. Occ. 1160. Iria pruriens; Aubl. Guian. 695. t. 279.). — Leaves ovate, acute, entire. Panicles as long as the leaves. Segments of the calyx lanceolate, pointed, spreading. Follicles hairy at the base; finely serrated. Native of the woods of Guiana, flowering in October and bearing fruit in May. Aublet. One of the largest trees of that country, its trunk being fifty or sixty feet high, and four or five in diameter. The bark is reddish, thick. Wood white, not compact. Leaves from six to twelve inches long, firm, thick; green and smooth above; opaque, somewhat glaucous and roughish at the back. Panicles about the ends of the branches repeatedly compound, downy, spreading. Calyx yellow and downy on the outside, red and smooth within. Columns nearly as long as the calyx. Anthers ten. Follicles three, four, or five, large, almost woody, clothed at the base with a tuft of long reddish hair; their cavities filled with fine, rigid, pungent, red bristles, enveloping the black seeds, and causing an indescribable itching, when ineffectually handled.

10. S. frondosa. Wasty-leaved Sterculia. Richard Afl. Soc. Hist. Nat. Paris, v. 1. t. 111. Lamark n. 6. — "Leaves crowded, oblong-obovate, very blunt, somewhat wavy, smooth and shining. Panicles axillary, on long stalks." — Native of Cayenne. Richard. We suspect this plant may have been confused with the latter, even by Dr. Swartz. A specimen gathered by M. De Ponthieu, in the West Indies, and given us by sir J. Banks, having very large and wavy leaves, answers so far to Richard's description. Some of its leaves seem moreover to be slightly ribbed; and as Dr. Swartz cites De Ponthieu, it should seem that corresponding specimens to ours have been his only authority. Thus Willdenow has been led to alter the specific character of S. crinata for the worse.

11. S. cordifolia. Heart-leaved Sterculia. Cavan. Diff. n. 1414. t. 143. f. 2. Willd. n. 4. Lamark n. 7. — "Leaves roundish heart-shaped, oblong three-lobed, five-ribbed, smooth. Follicles downy at the outside, brightly within."—Brought from Senegal by Adanson, and preserved in Jussieu's herbarium. The above characters sufficiently mark this species. Its leaves are two or three inches long, and almost equally broad. Footstalks not an inch in length. Flowers not observed.


13. S. macrophylla. Large-leaved Sterculia. Venten. Malm. sub fol. 91. Lamark n. 10. — "Leaves roundish heart-shaped, somewhat wavy, rather coriaceous; downy beneath. Follicles very smooth within, with two seeds." — Native of Java. La Haie. The leaves are about eight inches broad, round, or slightly oval; heart-shaped at the base; thick and rather coriaceous; smooth and dark-green above; downy, and reddish or whitish beneath, with strong branching lateral ribs; their margin entire, slightly wavy. Footstalks filiform. Panicles terminal, moderately branching. Follicles strong, reddish, wrinkled, obtuse. Flowers not observed. Poirier.

14. S. colorata. Coral-flowered Sterculia. Roxb. Coromand. v. 1. t. 26. t. 25. Willd. n. 5. Lamark n. 12. — Leaves palmate, five-lobed, pointed; somewhat downy beneath. Calyx downy, club-shaped, with yellow upright lobes. Follicles filiform, membranous, oblong, reticulated, expanded, smooth. — Native of mountains in the East Indies, bearing its leaves during the cold season, and flowers in April, soon after which fresh leaves appear. The name of the Centoo, or Teltinga, name is Karaka. This is a very large tree, with smooth greyish branches, leafy at the end. Leaves on long stalks, more or less deeply five-lobed, heart-shaped above; at the base, five-ribbed, minutely reticulated; smooth above; at the base, five-ribbed, minutely reticulated; smooth above; at the base, five-ribbed, minutely reticulated; smooth above; at the base, five-ribbed, minutely reticulated; smooth above; at the base, five-ribbed, minutely reticulated; smooth above; at the base, five-ribbed, minutely reticulated; smooth above.
pound, dense, their stalks, as well as the calyx, thickly clothed with flary pubescence, of a bright orange-scarlet. Calyx half an inch, tubular, erect, gradually tapering down into the flalk. Column longer than the calyx, slender. Anthers crowded and confluent. German five-lobed, with five short recurved stigmas, rather like separate styles. Follicles five, pendulous, converging, each on a partial stalk near an inch in length, their form lanceolate-oblong, obtuse, nearly flat, three inches in length and almost one in breadth, their texture membranous, with one rib and many reticulated veins, their surface smooth, thinning, pale purple externally, yellow within. Seeds two, oval, smooth, yellow, the size of a large pea, attached one to each margin of the follicle an inch above the base.

15. S. sanguinea. Stinging Sterculia. Roxb. Coromandel. v. 1. 25. t. 24. Willd. n. 6. Lamarck n. 11. Ait. n. 3. — Leaves five-lobed, pointed, very downy; deeply heart-shaped at the base. Calyx bell-shaped. Column conical. Follicles seseile, coriaceous, rough with pungent bristles. Native of mountainous parts of the coast of Coromandel, flowering during the cold season, and putting forth leaves, as the fruit advances, in the beginning of the hot weather. This is a very large tree, whose soft spongy wood scarcely serves but to make Hindoo guitars. The branches have the odor of violets. Leaves measuring from nine to twelve inches each way, much less deeply lobed than the leaf, on long stalks. Panicles repeatedly compound, shorter than the leaves, with a linear brown bract among each subdivision. Such bracteas however are not, as Wildenow supposes, peculiar to this species, though they are usually so to deciduous, in many instances, as to escape notice. The flowers are small, greenish-yellow. Column short and thick. Anthers ten, supported by a more dilated membrane than in many others of the genus. Style filiform, short and thick, with a five-lobed stigma. Follicles five, greenish-brown, an inch and a half long, oval, coriaceous, concave, clothed with copious tinging bristles, so as not to be touched with impuinity. Seeds four or five, oval, the size of a pea, rosetted and eaten by the Hindoos.

16. S. villifera. Villous Sterculia. Roxb. Mss. — Leaves five-lobed, pointed, toothed, very downy, seven-ribbed; heart-shaped at the base. Calyx deeply five-cleft, spreading. Column cylindrical. Follicles coriaceous, rough with flary hairs. Native of the coast of Coromandel. Our specimen was given by Dr. Roxburgh to lord vificot Vaux. The flowers are of a very fine color, not so strong and abundant as at one time. The leaves much larger than those of S. sanguinea, with a longer and more slender column, as well as style; the latter, like the German, very hairy. Calyx widely spreading, downy, with deep ovate segments. follicles covered with rigid flary pubescence, but no tinging hairs.

17. S. platamifolia. Plane-leaved Sterculia. Linn. Suppl. 233. Willd. n. 7. Lamarck n. 9. Ait. n. 45. Cavan. Diff. n. 17. t. 145. Vahli Synb. v. 1. 80. Sterculia Jacq. 81. in Ait. Nov. Helvet. v. 1. 40. t. 5. 3. 4. T. somentosa; Thum: Ic. Pl. Jap. dec. 4. "Firmiana; Marfil in Ait. Acad. Patav. v. 1. 106. t. 11. 9." Calhounia; Forik. Africa. 96. Hibiscus simplex; Linn. Sp. Pl. 977. — Leaves palmate, smooth, five-lobed; heart-shaped at the base. Segments of the calyx linear, very deep. Follicles stalked, membranous, ovate, reticulated, concave, roughish. — Native of China and Japan, from whence it has been diffused over many parts of the East Indies, and introduced into the gardens of Europe. At Radus it ripens seeds in the open air. In England it is a hardy greenhouse plant, flowering in July. The tree in its native soil is said to attain a vast size. The leaves are broader than long, measuring from ten to eighteen inches across, on long smooth stalks; with acute entire lobes, and rounded sinuses; smooth above; rather papyraceous, and sometimes sparingly downy, beneath; their ribs and veins strong with axillary, tubular, hairy pores. Panicles terminal, a foot long, much branched, spreading, downy. Calyx pale yellow, hairy externally; its segments reflexed and twisted, above half an inch long. Column smooth, slender, a quarter of an inch in length. German pyramidal, hairy, as well as the simple cylindrical style. Follicles molt like those of S. colorata, n. 14, but green, much broader, and more concave. Seeds two or three, globoso. Jacquin says the flowers are fragrant, most of them perfect, a few males only being interperfused.

18. S. satis. Fetid Sterculia. Linn. Sp. Pl. 1421. Willd. n. 8. Lamarck n. 8. Ait. n. 5. Cavan. Diff. n. 412. t. 141. Sonnerat Ind. Occ. v. 2. 254. t. 132. (Clompanus major; Rumphi: Amboin. v. 3. 168. t. 107.) — Leaves digitate. Segments of the calyx oblong, very deep, hairy. Follicles woody. — Native of the East Indies. Sonnerat says it is planted before houles, on the coast of Malabar, for the sake of its thick shade. The roasted seeds taste like oheafuts, and are eaten by the Indians. The tree is straight and tall. Leaves from seven to nine lanceolate, a finger's length, entire, smooth, on a long common footstalk. Clusters terminal, compound, drooping, with smooth stalks. Flowers smelling like human excrement, larger than the leaf, widely expanded; moss hairy, and of a brownish-red, on the upper side; brighter red underneath. Column cylindrical, near half an inch long, much dilated, or cup-shaped, at the top, where the anthers are inserted. German roundish, five-lobed, very hairy, as well as the simple style. Follicles oval, obtuse, wooly, nearly as big as the leaf. Seeds numerous along each margin, Karl, Rhode Malab. v. 4. t. 35, cited by Linnaeus, seams rather of the order of Ysicus.

A superficial confederacy of this very curious and remarkable genus might lead us to think nothing more easy than to divide it into several; but however strikingly different certain parts of the fruitification may be in some species, such differences do not support each other. Thus, the follicles of S. colorata and platamifolia are so unlike all the rest, and agree together so remarkably in their partial development of the fruit, that we should at once consider them as a distinct genus. But when we consider their sepals and styles, all particular relationship seems dissolved; for they accord better, in those parts, with many other Sterculia than with each other. Whether the simple or manifold styles, when properly understood, may lead to generic distinctions, we have not, as yet, materials to decide. The length of the column, very different in different species, does not appear of any generic importance.

The stipulas of this genus have hardly been noticed, because so fugacious, but we believe they are always originally present, in pairs, at the base of the footstalks, and usually of a lanceolate or scale-shaped figure. The bracteas, frequent under the branches of the panicles, are larger, but nearly as quickly deciduous as the stipulas, at least in most of the species.

STERCULIUS, in Mythology, one of the names given to Saturn, because he was the first that laid dung upon lands to make them fertile.

STERCUTUS, the god of ordure.

STERE, in Commerce, the unit for solid measure in the new French system. See Measures and Standard.
STEREOBATA, or Stereobates, formed from *Stereo-
Caume*; solid prop. in the Ancient Architecture, the baulk, or
foundation, whereon a column, wall, or other piece of building
is raised.

This answer pretty well to the continued foces or base-
ment of the moderns. See Socle.

Some confound with the ancient *sylobata, or pedestal*,
(which see); but, in effect, the Stereobata is that to the
sylobata, which the sylobata is to the spire or base of the
column.

STEREOCAULON, in Botany, from *Stereo*; hard and
solid, and *caulo* a fem. a name singularly applicable to this
genus of the Lichen tribe, invented by Schreber in his Gen.
Pl. 768.—Achar. Meth. 314. Lichenogr. 113. t. 12. f. 3. 4.
Lichenes.

Eff. Ch. Tubercles turbinated, coloured, convex, bor-
ted, terminating the branches of the solid cartilaginous frond.

As it stands at present, in the newly-published *Symphoric* of
Acharius, where nine species are enumerated, this has every charac-
ter of a natural genus. Its firm, branching frond, attached by a slender but very tenacious root, is formed to
occupy the interstices of crumbling granite, and especially the
cells of volcanic scoria. Hence it is the first of its tribe
that clothes the flowly decaying lava of Vesuvius and other
burning mountains.

Of the nine species of Stereobata above-mentioned, we
feel safe to exempt the genus.

t. 157.) Engl. Bot. t. 282. Coralloides crispus et botry-
forme alpinum; Dill. Mufe. 114. t. 17. f. 33. C. pach-
chale; Hoffm. Pl. Lich. v. i. 23. t. 5. f. 1.)—Frond gla-
cious-grey, branched, granulated, minutely fibrous, with
short, crowded, much-divided segments. Tubercles fatter,
cluttered, somewhat pointed, dark brown.—Native of the
highest mountains of Europe, in a mucaceous soil.
The *fema* form dense, very firm and tenacious tufts, from
one to three inches high, and are round, white internally,
quite solid. Their branches, much subdivided, are engrailed
with grey, warty, leafy segments, and tipped with numerous
little brown tubercles, sometimes compound, or lobed.

Such is our only certain British species. What occurs on
the lava of Vesuvius, and which we did not, in gathering it,
discover to be at all different, is called by Perlocco S. *ves-
uvianum*, and made a variety by Acharius of his own S. be-
trypsum, n. 3. a Swiss species, unknown to us, whose charac-
ters indeed do not found very distinct.

STEREOGRAPHIC Projection of the Sphere, is that
in which the eye is supposed to be placed in the surface of
the sphere. For the fundamental principles and chief proper-
ties of this kind of projection, see Projection, Stereo-
graphic.

The method and practice of this projection in all the
principal cases, viz. on the planes of the meridian, equino-
cial, and horizon, are as follow.

STEREOGRAPHIC Projection on the Planes of the Meridian.
Let Z Q N E (Plate XIV. Geometry, fig. 10.) be the
meridian; Z and N the poles, as also the zenith and nadir;
E Q the equinoctial and horizon; Z N the equinoctial cu-
ture, and prime vertical circle; Z 15 N, Z 30 N, Z 45 N,
&c. are hour-circles, or meridians, and also azimuths, be-
cause the pole is in the zenith. To describe these circles,
find the points 15, 30, 45, 60, &c. in the equinoctial, by
setting the half-tangent of their distance from $\gamma$; and then
their centres are found by setting their co-fecantes both ways,
from their points of intersection with the equator: $\omega$, $\varphi$, and $\psi$, $\zeta$, are the northern and southern tropics, which are
described by setting the half-tangent of 30° 30′ from $\varphi$ each
way; then the tangent of its complement, $\omega$, 60° 30′, each
way from thence on the colure produced, gives their centres.
By this method all parallels of declination may be drawn.
Or you might have set the co-fecant of the parallel from
the centre of the primitive, which would also have found
the same point for the centre of the parallel, whose radius
is equal to the tangent of its distance from its pole.

The parallels in this projection are also alimacants, or
parallels of altitude; $\omega$, $\psi$, is the ecliptic, which must be
divided from the division on the scale of half-tangents; but
denominated according to the signs in the zodiac, reckoning
50° to each sign.

STEREOGRAPHIC Projection on the Plane of the Equinoctial.
Let S C (fig. 11.) be the meridian, and folliollar colu-
E N the equinoctial colure, and hour-circle of 60° P the
north pole; $\omega$, $\varphi$, the northern tropic; E W N the north-
ern half of the ecliptic (whose centre is found by setting off
the fecant of 30° 30′ from $\omega$); and its pole is at $\alpha$, the
intersection of the polar circle and meridian, being the place
through which all circles of longitude must pass; and
E Z N the horizon of London, which is described thus: set
the half-tangent of the colatitude from P to Z; then the
tangent of the fame, from P to O, or its fecant from Z
to O, gives its centre; and its pole will be at $b$, 36° 30′
in the (half-tangents) diffrant from P, where $b$ is at the
zero.

To draw any other circles in this projection. 1. For cir-
cles of longitude—which must all pass through $a$, and the
several degrees of the ecliptic; set the tangent of 60° 30′,
from $a$ downwards, on the meridian produced, which will
find a point, through which a perpendicular, drawn to the
meridian, shall contain in it the centres of all the circles of
longitude, whose distances set off to the radius P $\alpha$, shall be
the tangents of the degrees of their distances from the meri-
dian S P C (which is that belonging to 180°). 2. All
parallels of declination are drawn, by setting off the half
of their tangents of their distances from P. 3. All azimuths,
or vertical circles, must pass through $b$ at the zenith: since,
therefore, the zenith is 38° 30′ diffrant from P, set the co-
fecant of that (or the fecant of 51° 30′) from $b$ on the
meridian extended below, and that will find the point $a$, the
centre of the azimuth of east and west; $\text{vis. E 6 N}$; and the
centres of all the rest are in a line that is perpendicular to
the meridian, and drawn through $a$. 4. Circles of altitude, or
alimacants, are lesser circles, whose poles are not in the plane
of the projection; thus the circle $O 6$ is a parallel of alti-
itude 50° above the horizon. 5. All hour-circles are straight
lines from the centre to the limb.

STEREOGRAPHIC Projection on the Plane of the Horizon.
First draw a circle representing the horizon, and quarter it
with two diameters; then will $a$ be the zenith of the place;
$12 \pm 12$ the meridian; $6 \pm 6$ the prime vertical, or azimuth
of east and west (fig. 12.) Make $a P =$ half-tangent of $38° 30′$ (or tangent of 10° 15′); and $P$ shall be the
pole of the world. Make $a E =$ half-tangent of 51° 30′ (or
tangent of 26° 45′); and $E 6 =$ fecant $\frac{1}{3} 38° 30′$; then shall $a$ be the
centre of the equinoctial 6 $E 6$.

In this projection alimacants are all parallel to the prin-
time circle; and azimuths are all right lines passing through
the centre of the primitive, to the equal divisions in the
limb. Parallels of declination are all lesser circles, and parallel
S T E

let to the equinoctial, and their intersecions with the meridian are found, by setting the half-tangent of their distance from the zenith, southward or northward, or both ways from it. Their centres are found by bisection the distance between these two points; for the middle will be the centre of the parallel. Thus, $\pi = \text{half-tangent of } 28^\circ 00' = \text{distance of the tropic of } \varphi \text{ from the zenith}$; and $\pi \cdot \varphi = \text{half-tangent of } 75^\circ$ to the southward, or $\varphi$ from the zenith from the northward.

And the intersection again with the north of the meridian, is at $105^\circ 30'$ for $\varphi$ to the northward, or upward from $\pi$.

For the hour-circles, make $\pi \alpha = \text{tangent of } 51^\circ 30'$, or $\pi \alpha = \secant of 51^\circ 30'$; draw $G \alpha T$ perpendicular to the produced meridian; then, if from $\alpha$, with the radius $\pi \alpha$ you set off the tangents of $15^\circ, 30^\circ, 45^\circ$, &c. both ways, you will have the centres of the several hour-circles, 7 and 5, 8 and 4, &c.

Note, in all stereographic projections, all diameters are measured on the scale of half-tangents; and this is the ground of all dialling, or the true projection of the hour-circles of the sphere on any given plane. See Perspective, Projection, and Spheres.

STEREOMETRY, is that branch of solid geometry which demonstrates the properties, and shews the construction, of all solids which are regularly defined.

It explains the methods for constructing the surfaces in planes, so as to form the entire body, or to cover the surface of a given solid; or, when a solid is bounded by plane surfaces, the inclination of the planes is determined by the rules of stereometry. The sections of solids are also a branch of stereometry; but this we shall refer to the article Stereotomy, with which it is more intimately connected.

Mr. Hamilton has denominated the principles of perspective by the name of stereometry; but in this sense the term is too limited, as perspective is only a branch of the doctrine of solids, and extends only to the sections of pyramids and cones, and the representations of solids. See Perspective.

The eleventh and twelfth books of Euclid, which treat of the properties of solids, may be looked upon as the elements of this branch of geometry; and to them we shall refer our readers for the first elements to be acquired.

It is somewhat singular, that though the first principles of solids have long been demonstrated, no practical application to mechanical constructions has been made. The knowledge of solids is of the greatest importance in the constructive parts of architecture, as in masonry, bricklaying, carpentry, &c.

To be proficient in the art of construction, this branch of geometry is indispensable, and contains the very essence and foundation of the whole in abstract.

Definitions.

1. A solid is that which has length, breadth, and thickness.

2. The exterior surface of a solid is called its superficies.

3. A straight line is perpendicular or at right angles to a plane, when it makes right angles with every straight line meeting it in that plane.

4. A plane is perpendicular to a plane, when the straight lines drawn in one of the planes, perpendicularly to the common section of the two planes, are perpendicular to the other plane.

5. The inclination of a straight line to a plane is the acute angle contained by that straight line, and another drawn from the point in which the first line meets the plane, to the point in which a perpendicular to the plane drawn from any point of the first line above the plane meets the same plane.

6. The inclination of a plane to a plane is the acute angle contained by two straight lines, drawn from any of the same points of their common section at right angles to it, one upon one plane, and the other upon the other plane.

7. Two planes are said to have the like inclination to one another, which two other planes have, when the fad angles of inclination are equal to one another.

8. Parallel planes are such as do not meet one another, though produced.

9. A solid angle is that which is made by the meeting of more than two plane angles, which are not in the same plane, in one point.

10. Similar solid figures are such as have all their solid angles equal each to each, and which are contained by the same number of similar planes.

11. A prism is a solid of which the ends are similar and equal plane figures, and the sides parallelograms.

12. When the ends of the prism are perpendicular to the sides, it is called a right prism; but if otherwise, it is termed oblique.

13. When the sides and ends of the prism are equal squares, it is called a cube.

14. When the ends are parallelograms, the prism is called a parallelepiped; and when the sides of the parallelepiped are at right angles to each other, then the prism is called a rectangular prism.

15. When the ends of the prism are circles, it is called a cylinder; but if the ends are ellipses, and alike situated, the prism is then called a cyllindroid.

16. The straight line extended between the centres of the two bases is called the axis.

17. A solid having any plane figure for its base, and its sides plane triangles terminating in the same plane, is called a pyramid.

18. A solid having a circle for its base, and terminating in a point, such that a straight line extended from any part of the circumference of the base to the terminating point may be in the surface of the solid, is called a cone; and the surface which lies between the circumference of the base and the terminating point is called the conic surface.

If the plane of a circle be supposed perpendicular to a given plane, with its circumference or edge upon that plane; and if there be a straight line passing any other point perpendicular to the said plane; and if another straight line be made to move parallel to the plane on which the circle stands, so as always to touch the circumference and the straight line, beginning at any given point, and proceeding entirely round until it arrives at the same plane; then the solid bounded by the circle, and the surface passed over by the straight line contained between the circumference of the circle and the straight line, is called a conoid, and the surface generated by the straight line is called a conoidal surface.

A sphere is a solid formed by the revolution of a semicircle upon its diameter.

The centre of a sphere is the same with that of the semicircle.

The diameter of a sphere is any straight line which passes through the centre, and is terminated both ways by the superficies of the sphere.

A cube is a solid figure contained by six equal squares.

A tetra-
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A tetrahedron is a solid figure contained by four equal and equilateral triangles.

An octahedron is a solid contained by eight equal and equilateral triangles.

A dodecahedron is a solid contained by twelve equal pentagons, which are equilateral and equiangular.

An icosahedron is a solid contained by twenty equal and equilateral triangles.

The solids defined in the last five definitions are called the five regular solids.

Properties of Planes and Solids demonstrated in the eleventh Book of Euclid's Elements, useful in Stereography.

PROPOSITIONS.

I. One part of a straight line cannot be in a plane, and another part above it.

II. Two straight lines which cut one another are in one plane, and three straight lines which meet one another are in one plane.

III. If two planes cut one another, their common section is a straight line.

IV. If a straight line stand at right angles to each of two straight lines in the point of their intersection, it shall all be at right angles to the plane which passes through them.

V. If three straight lines meet all in one point, and a straight line stands at right angles to each of them in that point, these three first straight lines are in one and the same plane.

VI. If two straight lines be at right angles to the same plane, they shall be parallel to one another.

VII. If two straight lines be parallel, the straight line drawn from any point in one to any point in the other is in the same plane with the parallels.

VIII. If two straight lines be parallel, and one of them at right angles to a plane, the other shall also be at right angles to the same plane.

IX. Two straight lines which are each of them parallel to the same straight line, and not in the same plane with it, are parallel to one another.

X. If two straight lines meeting one another be parallel to two other that meet one another, and are not in the same plane with the first two, the first two and the other two shall contain equal angles.

XI. Problem.—To draw a straight line perpendicular to a plane from a given point in space above the plane.

Draw any straight line in the plane and from the given point above the plane; draw a second straight line at right angles to the first straight line; from the point where the perpendicular meets the first straight line draw a third straight line in the plane, at right angles to the said first straight line; and, lastly, from the given point in space draw a fourth straight line at right angles to the third straight line; and the fourth straight line, thus drawn, is perpendicular to the plane.

XII. Problem.—To erect a straight line at right angles to a given plane from a given point in the plane.

From any given point above the plane draw a straight line perpendicular to the plane, and through the given point in the plane draw a straight line parallel to the other straight line; and the second line, thus drawn, is the perpendicular required.

XIII. From the same point in a given plane there cannot be two straight lines at right angles to the plane, upon the same side of it; and there can be but one perpendicular to a plane from a point above the plane.

XIV. Planes to which the same straight line is perpendicular are parallel to one another.

XV. If two straight lines meeting one another be parallel to two straight lines which meet one another, but are not in the same plane with the first two; the plane which passes through these is parallel to the plane which passes through the others.

XVI. If two parallel planes be cut by another plane, their common sections with it are parallels.

XVII. If two straight lines be cut by parallel planes, they shall be cut in the same ratio.

XVIII. If a straight line be at right angles to a plane, every plane which passes through it shall be at right angles to that plane.

XIX. If two planes cutting one another be each of them perpendicular to a third plane, their common section shall be perpendicular to the same plane.

XX. If a solid angle be contained by three plane angles, any two of them are greater than the third.

XXI. Every solid angle is contained by plane angles, which together are less than four right angles.

XXII. If every two of three plane angles be greater than the third, and if the straight lines which contain them be all equal, a triangle may be made of the straight lines that join the extremities of those equal straight lines.

Properties of Solids arising from the Definitions.

In a prism, all parallel sections which cut the sides are similar and equal figures; or, all parallel sections which would cut the plane of the base, if produced, are similar and equal figures.

In a pyramid, all the parallel sections which are not parallel to the plane of the base are unequal similar figures.

The properties of a cone are numerous and interesting. If the cone is cut parallel to the plane of the base, the section is a circle; if it be cut in any direction through the apex, the section is a plane right-lined triangle; if the cone be cut by a plane inclined to the plane of the base at any given angle, the section is an ellipse; if the cone be cut by a plane parallel to any straight line within the solid passing through the apex, the section is denominated a hyperbola; if a cone be cut by a plane parallel to another plane which touches the curved surface, the section formed by this position of the cutting plane is called a parabola.

For the purposes of stereography, we shall suppose the cone a right cone, and consequently the abscissa of the curves or sections will bisect all the double ordinates at right angles.

If any semi-conic section be supposed to revolve upon its abscissa, so as to perform an entire revolution, the surface generated by the curve line is called a conoid, and the abscissa the axis.

If the semi-conic section be a semi-ellipse, the solid generated is called an ellipsoid.

If the generating figure be a semi-parabola, the solid is called a paraboloid.

If the generating figure be a semi-hyperbola, the solid is called an hyperboloid.

All solids whatever, generated by revolving plane figures upon an axis, are called solidos of revolution.

All parallel sections of conoids are similar figures.

General Principles of Stereographic Constructions.

Definition.—Solid angles which consist of three plane angles are called trihedral.

In the construction of trihedral, besides the three plane angles which form the boundaries of the solid, are the three inclinations.
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Inclinations. These inclinations are, by way of distinction, called the angles, and the three boundaries are called the sides, and the sides and angles are indifferently called parts, any three of which, excepting the three angles, may be found by the following constructions. We shall first show the construction of right-angled trihedral, not only as being the most useful, but as being necessary to the construction of oblique trihedral.

Problem I.

In a right-angled trihedral are given the two sides containing the right angle, to find the acute angles, and the side or hypotenuse which subtends the right angle.

Make the angle $EBH$ (Plate 1. Stereography, fig. 1.) equal to one of the given sides, and the angle $EBF$ equal to the other; draw $EH$ perpendicular to $EB$, and $EI$ perpendicular to $BF$, cutting $BF$ at $F$: from $B$, with the radius $BH$, describe an arc, cutting $EI$ at $F$, and join $BI$: then $BI$ is the hypotenuse: from $E$, with the radius $EF$, describe an arc, cutting $EB$ in $G$, and join $GH$: then $EGH$ is the angle contained by the hypotenuse and the side $EBF$, or the angle opposite the side $EBH$: or make $FI$ equal to $GH$, and join $BI$.

In the same manner the angle opposite the side $EBF$ may be found.

The reason will appear thus: raise the plane of the triangle $BEF$ upon $BE$, so as to be perpendicular to the plane $BEH$; raise the triangle $EGH$ upon $EH$, until $EG$ fall upon $EF$; then the plane $EGH$ will become perpendicular to $BF$: revolve the plane $BEF$ upon $BF$, and $FI$ will describe a circle, whose plane is also perpendicular to $BF$, from the point $F$; therefore, the plane of the circle and the plane $EGH$ will be both in the same plane; therefore, since the point $F$ coincides with $G$, the straight line $FI$ may be made to coincide with $GH$: let this coincidence take place; and because $FI$ is equal to $GH$, and the point $G$ falls upon $F$, the point $I$ will fall upon $H$; therefore, the straight line $BI$ will fall upon $BH$; and the angle $FBI$, joining $FB$ and $BH$, is the hypotenuse.

Again, it is evident from the planes thus raised, that the angle $EGH$, contained by the planes $BEF$ and $FBI$, and perpendicular to $FB$, their common intersection, is the measure of the angle contained by the planes $BEF$ and $FBI$.

Problem II.

Given one of the sides containing the right angle and the angle opposite, to find the remaining side which contains the right angle.

Let the given side be $EBE$ (fig. 2.): in $BE$ take any point $F$, and make $EFH$ equal to the angle required; draw $HE$ perpendicular to $EB$; from $E$, with the radius $EF$, describe an arc $FG$: draw $BG$ a tangent at $G$, and $EBG$ is the side required. The demonstration is evident from the last.

Problem III.

Given one of the sides containing the right angle and the inclination or angle adjacent, to find the remaining side which contains the right angle.

Make $ABD$ (fig. 2.) equal to the given side: in $AB$ take any point $E$; draw $EG$ perpendicular to $BD$, cutting it at $G$, and $EH$ perpendicular to $AB$; make $EF$ equal to $EG$, and $EFH$ equal to the given angle; draw $BHC$, and $ABC$ will be the measure of the plane angle opposite.

The following propositions shew the construction of all the cases of trihedrals or spherical triangles, which are all represented by right-lined triangles. In each of the cases it will be found, that two of the sides of the spherical triangle are represented by the tangents of the arcs drawn from the same angle; and the angle included by these tangents is the measure of the spherical angle. The representation of the third side is a line joining the extremities of the tangents; the other two angles are measured by this proposition. If each of the three plane angles be denominated a side, and each of the three inclinations an angle, the geometrical construction will be the same as that of a spherical triangle, and the manner of expressing the data of the one is the same as expressing that of the other. The sides are always measured by the three plane angles of the fold angle.

Problem IV.

Given two sides and the contained angle, to find the other parts.

Make the angle $ABC$ (fig. 3.) equal to the contained angle: draw $BD$ perpendicular to $AB$, and $BE$ to $BC$; make $BD$ and $BE$ equal to each other, the angle $BDA$ equal to one of the containing sides, and $BEC$ equal to the other. Upon $C$ as a centre, with the distance $CE$, describe an arc $F$; and upon $A$ as a centre, with the distance $AD$, describe another arc, cutting the former at $F$. Join $FA$ and $FC$, then the angle $AFC$ will be the measure of the third side.

Now if the triangle $ABD$ be turned round the line $AB$, the triangle $CBE$ round $CB$, and the triangle $ACF$ round $AC$, until the points $D$, $E$, $F$, coincide, each of the two planes, $ABD$ and $CBE$, will be perpendicular to the plane $ABC$; thereore, there will be given two of the sides of a fold angle, one perpendicular to the other, to find the inclination of the vertical plane with that of the hypotenusal. Proceed, therefore, as in the last problem, and find the angle $GKH$, which will be the inclination of the two planes $CBE$ and $CAF$. In the same manner may the inclination of the planes $ABD$ and $ACF$ be found.

Note. The triangle $ABC$ represents the spherical triangle, of which $AB$ and $BC$ are the tangents of two arcs; and the angle $ABC$ is the spherical angle contained by the arcs, of which $AB$ and $BC$ are tangents.

Problem V.

The three sides of a spherical triangle being given, to find the angles.

Make the three angles, $ABC$, $CBE$, and $EBF$, (fig. 4. No. 1 and 2.) equal to the three sides of the spherical triangle, that is, to contain the same number of degrees. On $B$ as a centre, with any radius $AB$, describe an arc $AF$; draw $AC$ and $FE$ tangents at $A$ and $F$; join $CE$; draw the straight line $G$ equal to $CE$. On the centre $G$, with the tangent $AC$, describe an arc at $T$; and on the centre $H$, with the tangent $FE$, describe another arc, cutting the former at $I$. Join $GI$ and $HI$, draw $IK$ and $IL$ perpendicular to $IG$ and $IH$, making them equal to $AB$ or $BF$; join $KG$ and $LH$. Now if the triangles $GIK$ and $HIL$ be raised on the lines $GI$ and $HI$, until the points $K$ and $L$ coincide; then each of the triangles $GIK$ and $HIL$ will be perpendicular to the triangle $GHI$. Proceed, therefore, as in the fifth proposition, to find the angles, which in the representation of the spherical triangle $GHI$ are represented by $G$ and $H$.

Scholium.—Since each of the extreme angles may be made the middle angle in No. 1, the triangle $GHI$, No. 2, may be
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be laid down in three different figures, each of which will have three different angles included by each two tangents. These three angles, made in each separate triangle, are the measures of the three spheric triangles; but this mode requires more lines than that described in the above proposition.

There is another method of finding the angles of a spheric triangle, when the three sides are given, pointed out by Bishop Horley, at page 215 of his Elementary Treatises. The substance of it is as follows: Draw a right angle, and make one of the legs equal to the difference of the colines of the sides containing the required angle, the hypotenuse equal to the chord of the third side. Upon the remaining perpendicular side, as a base, construct a triangle, whose two other sides are equal to the sides of the sides containing the required angle; then the angle contained by the sides will be the measure of the spheric angle. This may be very easily accomplished by means of a scale of lines and chords from Gunter's scale.

PROB. VI.

Two angles and a side opposite to one of them being given, to find the other two sides and the remaining angle.

Make the angle $\angle ABC$ (fig. 5) equal to the spheric angle next to the given side; draw $BD$ and $BE$ perpendicular to $BA$ and $BC$; make $BD$ of any length, and $BE$ equal to it; and make the angle $BDA$ equal to the measure of the given side. Draw $AF$ perpendicular to $BC$, cutting it in $F$; make the angle $FAC$ equal to the complement of the other given angle. On the centre $F$, with the distance $FG$, describe an arc $GHI$. Draw $CHE$, a tangent to the arc at $H$, the same as in the second proposition. Join $AC$, and the angle $CEB$ will be the measure of the included side. On the centre $C$, with the distance $CE$, describe an arc at $K$; and on the centre $A$, with the distance $AD$, describe another arc, cutting the former at $K$. Join $AK$ and $KC$; then will $AKC$ be the measure of the third side of the spheric triangle.

PROB. VII.

Given two angles, and the contained side, to find the other three parts.

Make $\angle ABC$ (fig. 3) one of the given angles. Draw $BE$ perpendicular to $BC$. Make $BEC$ equal to the number of degrees contained in the given side. In $BC$ take any point $G$. Draw $GI$ perpendicular to $CE$, cutting it at $I$, and $GK$ perpendicular on the other side of it. Make $CH$ equal to $GI$, and the angle $GHK$ equal to the other given angle. Draw $CKA$ (as in Prop. III.), then $ABC$ is a plane triangle representing the spheric one.

Now, because $ABC$ is the angle included by the tangents, draw $BD$ perpendicular to $BA$, and equal to $BE$, and join $DA$; then $BDA$ is the measure of the side, of which $AB$ is the tangent. On the centre $A$, with the distance $AD$, describe an arc at $F$; and on the centre $C$, with the distance $CE$, describe another arc, cutting the former at $F$. Join $FA$ and $FC$; then $AFC$ is the measure of the third side.

PROB. VIII.

Two sides, and an angle opposite to one of them, being given, to find the three remaining parts.

Draw $AC$ (fig. 6.), representing the side adjoining the given angle, and $AB$ perpendicular to it. Make the angle $ABC$ equal to the given side. In $AC$ take any point $E$. Draw $ED$ perpendicular to $BC$, cutting it in $D$, and $EG$ perpendicular to $AC$. Make $EF$ equal to $ED$; and the angle $EFG$ equal to the given angle. Draw the line $CGH$. On $A$ as a centre, with the tangent of the other given side, describe an arc $KH$; which, if it cut the straight line $CH$ in two points, $H$ and $K$, join $AK$ and $AH$. Draw $AI$ perpendicular to $AH$, and equal to $AB$. Join $IH$. On the centre $H$, with the distance $HI$, describe an arc at $M$; and on the centre $C$, with the distance $CB$, describe an arc, cutting the former at $M$. Join $HM$, $MK$, $CM$; then the angle $CAM$, or $CAH$, is the measure of the spheric angle. The measure of the angle $AHC$, or $ACK$, representing the spheric angle opposite the given side, thrown by the tangent $AC$, is found by Prop. I. The angle $CMH$, or $CMK$, is the measure of the remaining side, viz. that opposite the angle included by the tangents.

N.B. This case is not always ambiguous; for if $AH$ be equal or greater than $AC$, the arc $KH$ will only cut $HC$ in one point; and, therefore, there can only be one triangle; or, if the angle $AHC$ be a right angle, $AH$ will only touch $HC$; in this case also there is only one triangle.

PROB. IX.

The three angles of a spheric triangle being given, to find the three sides.

Take the supplements of each of the angles, and describe a triangle by Prop. V., whose sides are equal to these supplements; then the measure of the angles of this triangle will be the supplements of the sides of the triangle sought. This is demonstrated by writers on spheric trigonometry.

Though the writer of this article has not given formal demonstrations of the preceding propositions relating to the geometrical construction of spheric triangles, as it would have swelled the article too far, he hopes that enough has been said to enable any one, who has a clear conception of the parts of a spheric triangle, to describe the representation of it, and to find the measure of its parts in the most easy manner, without having recourse to the projection of the sphere, which frequently runs into conic sections, and, from their difficulty of description, renders the projection very inaccurate. The representation of the spheric triangle belonging to the preceding propositions, is nothing else than a plane triangle, which is a tangent to the sphere at one of the spheric angles, and whose sides are bounded by the intersections of the planes of the three great circles of the sides of the spheric triangle; consequently two of the sides of the representative triangle are always two tangents from the same spheric angle. The included angle by these tangents in the representative triangle is the measure of the spheric angle contained by the sides which the tangents represent. And the third side in the representative triangle is a line joining the extremities of the tangents, as has been already mentioned. In another point of view, the whole may be conceived to be a pyramid, whose sides are planes from the centre of the sphere, passing through the three arcs of the spheric triangle; and the base a triangle, a tangent of the sphere at one of the angles, which meets the sides. The vertical angles of the sides of this pyramid are the measures of the sides of the spheric triangle; the angles of the pyramid are the measures of the spheric angles; and the base of the pyramid is the representative triangle. Consequently one of the angles of the pyramid is always perpendicular to the base. The angle intercepted by the two planes upon the base is equal to the inclination of the planes.

The triangle belonging to the preceding propositions is such, that when all the parts are completed, the sides may be turned
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turned up upon the base, which is the representative triangle, until the edges of all the triangles forming the sides are united in one common vertex. A pyramid will then be formed, equal, similar, and similarly situated to that above.

The Rev. George Walker, in his ingenious doctrine of the sphere, Prop. I. p. 256, shews, that “if there be a spheric triangle, and a plane quadrilateral figure be formed, two of whose sides are the two segments of two of the sides of the spheric triangle, and the angle comprehended by the segments be measured by the spheric base, the angle comprehended by the tangents shall be the measure of the spheric angle opposite the base; the diagonals of the quadrilateral shall intersect each other at right angles; the segments of the diagonal joining the angle of the base, and the angle of the tangents, shall be the tangent and tangent of the spheric perpendicular, drawn from the vertical angle to the base; the angle which this diagonal makes with the segments shall be measured by the spheric segments of the base; and the angles which this diagonal makes with the tangents shall be the measures of the spheric angles which the perpendicular makes with the sides.” This theorem is very analogous to Prob. V.; but the properties shewn by it do not apply to the construction from any given data, nor can all the parts be found from any one datum; they may be very well applied when two sides and the contained angle are given, or when the three sides are given, by varying the triangle, as has been here shewn, in order to find the other two angles; but this is both troublesome and inelegant.

From what has been said, it will be easy to construct any solid similar to any other solid given, whose sides are planes, by constructing each solid angle, that is, by dividing it into as many solid angles, each consisting of three plane angles, wanting two, as the number of plane angles bounding the whole solid angle; then completing the figure of any side, of which a plane angle of the described solid angle is one similar to the side of the solid given. From the several angles of this figure construct other solid angles in the same manner.

PROB. X.

In a solid, such that all sections parallel to the base are similar and regular polygons, there are given the base of the solid, a vertical section perpendicular to the base through its centre, and to the sides of the polygon, to find the angular or common section at the meeting of every two equal and similar prismatic parts.

From the centre of the base draw a line at right angles to the sides of a polygon; apply the base of the perpendicular section to this straight line, which now call the base of the perpendicular section. Draw a line from one of the next angles to the centre of the base; call this the diagonal line. Take any number of points in the base of the perpendicular section, and draw lines parallel to that side of the polygon to which it is perpendicular, till they cut the diagonal line. From these intersections draw perpendiculars to the diagonal line. Draw perpendiculars also to the base of the perpendicular section, till they cut the curve of this section. From all the intersections of the diagonal apply all the perpendiculars of the section; through the points now found draw a curve, and it will be the section of the diagonal plane required. This will be evident, if the perpendicular, and diagonal sections are raised perpendicular to the plane of their bases.

Example.—Plate II. fig. 2. No. 1, is the hexagonal base of a solid, whose perpendicular section is ABC. Draw the diagonal BC. In BC take any number of points, s, through which draw the lines ef parallel to BD, cutting the diagonal line in the points f. From the points e draw the lines eg perpendicular to BC, cutting the curve AB in the points g; and from the points f draw the lines fb perpendicular to DC. Make all the lines fb equal to the lines eg; and through points D, b, b, &c., draw a curve, and CD I will be the diagonal section required.

This process may easily be reversed, by having the angular section given. In the same manner are the sections of figs. 2 and 3, No. 1, to be found, which, from what has been said, are plain to inspection.

In order to give a clearer idea of these solids, their elevations are shown at No. 1.

PROB. XI.

To find the covering of a cylinder, such as may be generated by a rectangle.

Make a rectangle; one of whose dimensions is the length of the axis, and the other the circumference of the base of the cylinder.

Example.—A B C D (fig. 4. No. 1.) is the elevation of a cylinder, G, (No. 2.) the base. The side DE, of the rectangle C D E F, is made equal to the circumference of G, and the breadth CD is the height of the cylinder.

If C D E F be wrapt round the cylinder A B C D, the edge E F will coincide with C D, D E with the base A D, and C F with the base B C: this is so evident that it wants no demonstration.

PROB. XII.

To find the covering of a cylindrical ungula, having the base of the cylinder; and the axis-section perpendicular to the inclined section of the ungula.

Let A c c e c c B (fig. 5.) be half the circumference of the base. Divide it into the equal parts A, c, c, c, c, c, &c.; and let E D F G be the axis-section, whose base D G is placed parallel to A B, the edge D E in a straight line with the extremity A, and G F in a straight line with the extremity B. Draw the lines e b parallel to D E, cutting the inclined line E F in the points b. Produce D G to L. On G L make the distances G n, n n, n n, &c., and n L, equal to B e, e, e, &c. Draw the lines n n parallel to D E, as a L I; and the line b L perpendicular to it. Through all the points k to I draw a curve, and G F I L will be half the covering: for imagine the part D F G E to represent the ungula, and the covering F G L I wrapt round F G D E; then, because that all the distances G n, n n, n n, &c., are equal to B e, e, e, &c., the points n will fall upon those of e, which are described in the elevation; and because that all the figures O b k n are parallelograms, all the lines n k will be equal to the lines o b, and the lines n k will fall upon those represented by o b, and the points k will fall upon those of h, and the part F G L I will cover half the ungula represented by F G D E.

PROB. XIII.

To find the covering of the curved superficies of a cone, such as may be generated by the revolution of a right-angled triangle about one of its perpendicular legs.

With a radius equal to the slant side of the cone describe an arc. Make the length of this arc equal to the circumference of the base. Draw two right lines from the centre to each extremity of the arc, then the sector comprehended by the two radii and the arc will be the curved superficies required.

Example.—Let A, (fig. 6.) be the base of the cone; B D C the
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the elevation, which also represents a section of the cone through the axis.

On, as a centre, with the slant side DC, describe an arc CE. Make the arc CE equal in length to the circumference of A. Join DE and DC, and the sector EDC is the covering required.

For CE being equal to the circumference of the base, when DEC is bent round the cone DBC, the straight line ED will meet CD, and all the points on the arc CE will coincide in the same plane with the base BC, since the superficies of the cone may be conceived to be divided into an indefinite number of isoclines triangles, whose vertex is the point D, and whose bases are in the base of the cone. The sector DEC may be conceived to be divided into as many isoclines triangles, which, when bent round, will respectively coincide with those of the cone.

PROB. XIV.

To cover a conical ungula, the cone from which it is a part being such as may be generated by the revolution of a right-angled triangle about one of its perpendicular legs, a section through the axis at right angles to the plane of the inclined section of the cone being given.

Let ABCD (fig. 7) be the section given. Produce AD and BC to meet it in E. Bisect the vertical angle AEB by EI, cutting A B at K. On the centre I, with a radius AK or KB, describe a circle FMGN. Draw the diameter FG parallel to AB. Divide the semi-circumference FMC into any number of equal parts, Fo, oo, oo, &c. Draw the lines op parallel to EI, cutting A B in the points p; the lines qn, qr, &c. parallel to AB, cutting BE in the points r. Make all the distances Bi, it, it, it, &c. on the arc BH, equal to Fo, oo, oo, &c. Draw EB, Ei, Ei, Ei, &c. On the centre E, with the radii ER, describe arcs, cutting the lines Et in the points t. Draw the curve line Ciss, &c. and BCLH will be the covering required; for the sector EHH will be the covering of the whole cone; Brii, &c. will coincide with the base; the lines Et will coincide with the lines Ep, and all the lines r will fall upon rq.

PROB. XV.

To cover a solid generated by the revolution of a semicircle, the section through the axis being given.

Produce any side AB (fig. 8) to the axis produced in C. On C as a centre, with the radii CA and CB, describe arcs AE and BD. Draw the radius EDC, and AEBD will cover a part of the frustum of a cone, represented by ABGF, as is evident from what has been said.

PROB. XVI.

In a solid, whose parallel sections to the base are all similar figures, and whose base is a regular polygon, there are given the base and the perpendicular section to find the covering of one of the curved sides.

Let ABCDE (Plate III, figs. 1, 2, and 3.) be the base, FGH the perpendicular section, G its base, drawn from the centre F, perpendicular to the side AE. Divide the curve GH into any number of equal parts Gi, ii, ii, &c. Draw the lines ii parallel to AE, cutting FG in the points k, and FE in the points l. Produce FG to P, making GP equal to the arc GH, and divide GP into the same number of parts in the points m, as GH is divided into the points k. Draw the lines mn at right angles to GP, and the lines in parallel to it; or make the lines mn equal to k, and through the points a draw a curve; then APE will be the covering of one of the curved superficies required.

If GHF be a quadrant, each edge of the covering will be the same as a part of that of a cylindrical ungula of the same diameter, cut at the same inclination as the angle FE C.

From what has been said it will be easy to conceive that any of these coverings must fit the surface they are made for. If the section G HF be raised upon the base GF until it becomes perpendicular to the plane ABCDE, and the covering APE bent round; the points m will coincide with those of it, and the lines mn will fall upon the lines kl.

There is another geometrical method of finding the superficies of a solid in plane, much more convenient in practice. The data for this method are the length of the curve of the perpendicular section; the figure of the perpendicular section; one of the terms or sides of the base of the solid. This rule is as follows: on the given term or side describe a figure similar to the perpendicular section of the solid, the term or side being the base of the similar section. Produce the vertical edge of the similar section indefinitely from the base. Upon this indefinite line set the length of the curve of the perpendicular section. Divide this line and the curve of the similar section both into the same number of equal parts. Through all these points draw lines parallel to the term or side of the base of the polygon, those of the similar section being cut at the perpendicular side. Take all the respective lengths of the sides, beginning with those next the base first of the similar section, and let them on the respective parallels in the same order from the base on each side of the line, cutting the parallels. A curve being traced through the points on both sides, will, with the base, be the boundaries required.

This is exemplified in figs. 4 and 5. ABC is the similar section to the perpendicular one; AB representing its base, BC its perpendicular, BD the length of the curve of the perpendicular rib, AE the side of the base of the solid. The manner of describing these coverings is plain to inspection. ABC (fig. 4.) is for a curve of contrary flexure; ABC (fig. 5.) is to answer a quadrant.

It may be remarked, that by whatever mode the curve of the perpendicular section is described, the same mode may be applied to describe the similar one ABC: if the outer edge of the perpendicular rib be a curve of contrary flexure, as in fig. 6, described from the fuzmuts of equatorial triangles; the similar rib ABC (fig. 4.) may be described in the same manner. To find the height BC, find a fourth proportional to the base, the perpendicular height of the perpendicular rib, and the side of the base of the solid; that is, suppose FGH (fig. 7) to be the perpendicular rib, GH its base, GF its height. Make AB to BC (fig. 4.) as HG to GF; that is, H G: G F: A B: B C.

To demonstrate the truth of the above method, it is only necessary to shew, that if the lines ip (fig. 1.) are drawn parallel to GF, intercepted by the line HF, all the lines kl, as they recede from GE are proportional to the lines ip, as they recede from GF.

Draw HK (fig. 7) perpendicular and equal to HG. Join KG. Make HK equal to AB (fig. 4.) that is, equal to half the breadth of a side of the base of the solid, and join IG. Draw L, M, N, O, P, from the points L, M, N, O, P, in the curve FH, parallel to GH, cutting GF in the points w, v, x, y, z, s, and let L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s, and L, M, N, O, P, be parallel to HG, cutting the points v, w, x, y, z, s.
G, G, G, O, G, G, T, G, U, are respectively equal to \( v \), \( M, x, N, y, O, z, F \); and because the similar triangles \( K H G, B O G, C H G, B O G, A O G, \) and \( A O G, \) and because \( K H G \) is equal to \( H C G \); \( U E T, D, \) \( S, R, B \); and \( Q, A \), are respectively equal to \( U, T, G, S, R, G, \) and \( Q, G \); therefore \( U E, T, D, S, R, B \), and \( Q, A \), are respectively equal to \( z, P, O, N, x, M, v \), and \( v, L \). Now \( H I, U, Z, T, Y, S, X, R, W, Q, \) and \( O, V, Q, \) are to one another as \( H K, U E, T, D, S, R, B \), and \( Q, A \); therefore \( H I, U, Z, T, Y, S, X, R, W, Q, \) and \( O, V, Q, \) are as \( P, x, M, v, \) \( L, v \); but \( A, B, c, d, e, f, \) \( g, b, i, k, l, m, \) \( (f \text{ fig. } 4) \) are to one another as \( P, x, M, v, \) \( L, v \); therefore \( H I, U, Z, T, Y, S, X, R, W, Q, \) \( (f \text{ fig. } 7) \) are also as \( A, B, c, d, e, f, g, b, i, k, l, m, \) \( (f \text{ fig. } 4) \); but \( H I \) is equal to \( A, B, \) \( (f \text{ fig. } 4) \); therefore \( A, B, c, d, e, f, g, b, i, k, l, m, \) are equal to \( H I, U, Z, T, Y, S, X, R, W, Q, \).

From what has been said, the geometricalian will soon perceive that the coverings \( A D E \) \( (f \text{ fig. } 5 \text{ and } 6) \) are what is called the figure of the lines.

Example.—Let \( A B C \) \( (f \text{ fig. } 8 \text{ N}^\circ 1, \text{ and } f \text{ fig. } 9 \text{ N}^\circ 2) \) be the generating plane, \( A B \) its axis, \( B C \) its base, \( B D \) half the base of the fold, \( B F F \) \( D \) the curve line of the section, \( A \) the equidistances \( B, f, f, f \); \( c, d \); and on the centre of the base \( G \), describe and cutting \( B C \), \( C \) the base of the section, in the points \( G \) draw the lines \( b \) perpendicular to \( B C \), cutting the curve in the points \( K \). Make \( I K \), \( (N^\circ 2 \text{ fig. } 9) \) equal to \( B, f, f, f \); \( c, d \); and let the points \( l, \) \( l \) in \( I K \), be those which correspond to \( f, \) \( f \); \( c, d \) \( (f \text{ fig. } 9 \text{ N}^\circ 1) \). Draw perpendiculars \( b \) to \( I K \), equal in length to \( B, f \), \( c, d \); and the curve \( K, m, m, m, I \), being drawn, will give the superficies of the prismatical part.

STEREOLOGY, \( \gamma \tau \epsilon \rho \iota \sigma \mu \alpha \kappa \varepsilon \tau \iota \gamma \mu \), formed of \( \sigma \mu \iota \varepsilon \), solid, and \( \mu \iota \varphi \gamma \sigma \rho \varepsilon \), measure, that part of geometry which teaches how to measure solid bodies, \( i, \) \( a, \) to find the solidity or fold content of bodies; as globes, cylinders, cubes, vases, ships, etc.

The methods hereof see under the respective bodies; as GLOBE, SPHERE, CYLINDER, etc. See also GAUGING.

STEREOTOMY, formed from \( \tau \iota \sigma \varepsilon \gamma o \), and \( \tau \iota \sigma \varepsilon \), section, is the science and art of cutting solids under certain specified conditions.

Stereotomy may be regarded as a branch of stereography, which is the science of folds in general. Mr. Hamilton has entitled his complete body of perspective, Stereography, which perhaps would have been more properly entitled Stereotomy, as the perspective representation of every object in nature is the section of a pyramid or cone of rays. But as it has not been the object of the writers on perspective to shew the rules for finding the sections of solids in general, under certain specified conditions, the cutting plane, nor of finding any other sections besides those of cones and pyramids, it is the express intention of this article to explain the general principles of the science for any given law, by which the surface of the fold may be constituted of straight lines, or that the surface may agree with the common section of two planes disposed in given positions. And as nothing of the kind has yet appeared, perhaps this attempt may be the more acceptable, particularly as it is in its principles the whole art of dialling is included, and the mechanical arts of masonry and carpentry. The art of stone-cutting, the squaring and cutting of timbers, and the formation of hand-rails, depend entirely upon the sections of solids.

PROB. I. Plate I. Fig. 1.

Given the fact, \( A, B, \) of the intersection in space of two planes, having a given inclination, and the intersection, \( A, C, \) of one of them in a given plane, \( Y \); also the inclination of the common intersection of the two planes to the plane \( Y \); to find the intersection of the other plane with the plane \( Y \).

Make \( B A D \) equal to the inclination of the intersection of the two planes: from any point \( D, \) draw \( D E \) perpendicular to \( A D \), cutting \( A B \) at \( E \); make \( E B \) equal to \( E D \); draw \( E C \) perpendicular to \( A B \); make the angle \( C B F \) equal to the inclination of the planes, of which the foot of their intersection is \( A B \); let \( B F \) meet \( E C \) in \( F \); and join \( A F \); then will \( A F \) be the intersection required.

Or thus: Through any point \( E \), in \( A, B, \) draw \( E \) \( C \) perpendicular to \( A B \); make \( E A D \) equal to the inclination of the intersection; draw \( E D \) perpendicular to \( A D \); make \( E B \) equal to \( E D \); join \( B C \); make the angle \( C B F \) equal to the inclination of the planes, which have \( A B \) for the foot of their intersection; let \( B F \) meet \( C E \) in \( F \); and join \( A F \); then will \( A F \) be the intersection required.

Demonstration.—Imagine the triangle \( ADE \) to be turned upon \( A, E \), until it becomes perpendicular to the plane \( Y \): let the plane \( Z \) be turned upon \( C \), until \( E \) falls upon \( D \); that \( E \) will upon \( E \) is evident, for \( E \) in revolving upon \( E \), will always be in a plane passing through \( E \) perpendicular to \( C \), and \( E \) is also in a plane passing through \( E \) perpendicular to \( C \); and since \( E \) is equal to \( E \), \( E \) must fall upon \( E \), and the point \( B \) upon \( D \); and the plane \( AED \) will be perpendicular to the two planes \( CA \) and \( CB \); therefore \( A \) will be perpendicular to the plane \( CEB \); whence it is manifest, that \( CBF \) is in a plane perpendicular to the common intersection, and is the measure of the inclination of the planes.

PROB. II. Fig. 2.

Given \( IN \), the intersection of a plane, \( W \), with another plane, \( X \), and their inclination, the fact, \( A, B \), in the plane, \( X \), of a line in space infiting at \( A \), and the inclination of the line to the plane \( X \); to find the section of the line in the plane \( W \).

Through any point \( B, \) in \( A, B, \) draw \( BS \) perpendicular to \( IN \), cutting \( IN \) at \( E \); make the angle \( BEF \) equal to the inclination of the plane: draw \( BG \) perpendicular to \( BS \); make the tangent of the radius \( A, B \); draw \( GF \) parallel to \( BS \); through \( A, \) draw any two lines \( AJ \) and \( AK \), cutting \( IN \) at \( J \) and \( K \); make \( ES \) equal to \( EF \); through \( S, \) draw \( VL \) parallel to \( IN \); produce \( BS \) to \( P \); make \( SP \) equal to \( PG \); draw \( PV \) parallel to \( AK \), and \( PL \) parallel to \( AJ \); and join \( KV \) and \( JL \), cutting each other at \( i, \) and \( a \), the section of the line in the plane \( W \), as required.

For imagine the triangles \( BFC \) and \( CBF \) in the same plane to be turned upon \( BE \), so that their plane may be perpendicular to the plane \( X \); then \( BG \) will be perpendicular to the plane \( X \), and the point \( G \) will fall in the line in space: imagine also the plane \( W \) to be revolved upon \( IN \), until \( ES \) fall upon \( EF \), as is evident for the same reasons as given in the first problem, and the point \( S \) will fall upon \( F \); then the line \( VL \) will become parallel to the plane. In revolving the plane \( W \) upon \( IN \), imagine the plane \( Y \) to revolve upon \( VL \) at the same time, so that the plane \( Y \) may always continue parallel to the plane \( X \); then \( VF \) will continue parallel to \( AK \), and \( LF \) parallel to \( AJ \); then, as in perspective, \( X \) is the original plane, \( W \) the plane of the picture, \( Y \) the vanishing plane, \( G \) or \( P \) the place of the eye coinciding therewith, \( IN \) the intersecting line, \( VL \) the vanishing line, \( J, K, \) the intersecting points.
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points, V L, the vanishing point, and the original line would then be a visual ray; therefore, by the theory of perspective, a is the representation of the point A.

**PROB. III.**

The same things being given, and the constructive lines remaining as in the preceding problem, as also the point a, the section of the line in space to find the feet of the line in the plane W, and its inclination to the said plane.

Draw G Q (fig. 3.) perpendicular to E F, meeting E F in Q ; in E P, make E T equal to E Q, and join T a: draw T R perpendicular to a T: make T R equal to Q G, and join R a; then will T a be the feet of the line in the plane W, and T a R its inclination to the said plane.

**Demonstration.**—For when E S is made to coincide with E F, as in the last problem, the plane F C G will be perpendicular to the plane of the section W, but the line F C being now in the plane W, and Q G being perpendicular to F C, Q G will also be perpendicular to the plane W: but the point G, that is, R, is a point in the line whose feet is A B, and the point a is another point in the line whose feet is A B: therefore, R and a are two points in the line whose feet is A B: then join a R, which will be the part of the line in space on the other side of the plane W, and a R its feet.

**Scholium.**—This amounts to the same thing as the feet and distance of the eye being given with respect to the original plane, and the position of a point in the said plane; to determine the feet and inclination of the visual ray.

**PROB. IV.**

Two straight lines, A B and C D, (fig. 4.) tending to an inaccessible point, being given, through a given point E, to draw a third straight line, to tend to the said inaccessible point.

From any point A, in A B, draw a straight line, A E, from A to the given point E, cutting C D in C; and through any other convenient point B, draw B F parallel to A E, cutting C D in D; join D F, a fourth proportional to A C, C E, B D, and join E F; then will the lines A B, C D, and E F, tend to the same point of concurrence.

**Scholium.**—It sometimes happens, that a number of lines radiate from the same point, and that from a given point it is required to radiate other straight lines, so as to meet the radiations given in a given straight line: some or many of the former radiations, according to their number, will be inaccessible; and though they may be all found by this problem, yet if the several operations are combined in one, much trouble will be saved.

Thus, let the radiations (fig. 5.) be A B, A C, A D, A E, A F, tending to the straight line B C; and let a be a given point, from which it is required to radiate other straight lines to meet or tend to the said points in B C, with those drawn from A. Join A a, cutting B C in G; and through any convenient point C in B C, draw F c parallel to A a; make c C equal to G a, and c C in Q in B C, produced to a, equal to G a; join P Q. Now let A D, A E, meet C F in D and E; draw D M, E n, F o, parallel to P Q, cutting B a at m, n, o; make C d equal to C m, C e equal to C n, c f equal to C o; draw d a, e a, f a, which are the lines required. This might also be nearly effected by the proportional compasses; but the centrelined, invented by the author of this article (Mr. P. Nicholson), is much preferable. It is described under the article SCANOGRAPHY, but has of late been much improved, and made to set at the first time.

**Example 1.**—Given the meridian A B (fig. 6.) in the plane of the horizon X, the latitude of the place, the intersection, I N, of the plane W, with the horizontal plane X, and the inclination of the plane W, to that of the horizon X; to construct a dial in the plane W.

In A B, take any point, A, for the foot of the style; then A B will be the feet of the style, or of the line tending to the pole of the world; the latitude of the place is its inclination. Find a the representation of A, that is, the section of the style of the dial in the plane W, by the second problem: produce A B to meet I N in D: draw D a in the dial-plane W; then, by the third problem, find a T, the feet of the style in the plane W, and the angle of elevation T a R: and by the first problem, find the intersections, U a, Y a, Z a, &c. of planes passing through the style, making angles respectively of 15°, 30°, 45°, 60°, &c. with the vertical plane passing through the meridian A B; that is, with the plane whose intersection is T a: the inaccessible lines are also found by the last problem; and the dial is constructed as required. a T is the feet of the style, whose intersection is T a; T a R its inclination; a D is the 12 o'clock line; and U a, Y a, Z a, &c. are the hour-lines. Another method of finding the sub-styles is thus: produce G Q to meet P E in H; join H A, which produce to N: draw N a the subfialyer line.

Thus, upon one common principle, the sections of lines, planes, and solids may be found. The sections of solids are found by means of the sections of planes: the construction of a dial is only finding the sections of planes, whose positions are given. This method is, perhaps, of all others the easiest to consider and to construct.

**Example 2.**—Given the base, A N Q R, (fig. 8.) of a pyramid, in the plane X, and the whole feet, A B, of one of its angular lines, the intersection, I N, of the cutting plane W, and the inclination of the planes W and X; to find the section of the pyramid.

Find the vanishing line, V L, of the plane X, and the vanishing points, V and L, of the lines A R, N Q, A N, R Q: produce A R to K, N Q to M, A N to J, and R Q to L, to meet the intersecting line I N; join K V and M V, also J L and L L; then angr will be the section of the pyramid inscribing upon A N Q R.

**Example 3.**—To find the section of a prism (fig. 7.), the same things as before being given. Find the vanishing points, V and L, of the lines A J and A K, and the representations, K V and J L, as before: draw L r parallel to J L, and M s parallel to K V, and q n a r will be the section of the prism required.

Plate II. fig. 3. To find the section of a cuneoid or cono-cuneus, the same things as before being given, the base of the fold being a b c d e f g h.

Let G a be the section of the plane, passing through the apex, and the centre of the base in the original plane, cutting the base of the fold in a and e: divide each half on each side of the diameter, a e, into any number of equal parts, as four: through the points of division draw lines parallel to a e, which produce to meet the intersecting line; and let a e meet it in G; then having drawn another series of lines at right angles, also to meet the intersecting line, find the vanishing points, V and L, of each of these series of lines: join G V: from the intersecting points of the lines parallel to a G, draw lines parallel to G V: also from the intersecting points of the other series of lines, draw lines to the vanishing point L; then the figure a b c d e f g h, formed by the intersections of these lines, will be the section of the cuneoid.

**Fig. 3.** shows the method of finding the section of a cylinder upon the same general principle, only with the difference,
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... that having found the vanishing points V and L, and the lines GV and HL; one set of lines is drawn from the intersecting points parallel to GV, and the other set is drawn from the vanishing point to HL; and by this means the figure abedfgb is the section of an oblique cylinder, whole set is i b.

Fig. 7. shows the section by the same general principle, differing from fig. 2, in this respect, that, instead of the lines being drawn from the intersecting points parallel to GV and HL, they are drawn from the point V and L as vanishing points, and by this means form the section abedfgb of the cone.

In the same manner may be found the section of a cone, when the cutting plane is parallel to one of its sides, that is, to a plane touching one of its sides, and thus giving the parabola for its section; and when the cutting plane is parallel to any plane within the cone passing through its apex, and forming the section into an hyperbola.

Figs. 4, 5, 6, 7, are other methods, not differing in principle, but in the manner of laying them down, which is very convenient in the practice of stereotomy.

IN is the intersecting line, IP the base of a plane perpendicular to the intersect line IN, and IE the inclination of the plane: the point E is found as in the former cases: draw I E perpendicular to IE.

In fig. 4, B is the earth of the axis of a cone, whose section is thus found: for the sake of simplicity, divide the base, or its half, into equal parts, and draw one series of lines perpendicular to IN, to meet IN, and another through the base points perpendicular to IP, to meet IP: from these points, draw lines to D, to meet IE; and from these lines in IE, draw lines parallel to i n: make IN equal to IN, and n p equal to IN, n q equal to N Q: draw n E, p E, q E: let the same distances on the other side of a on I n produced from those points: draw lines again to E, and the figure abedfgb in the plane Z will be the section of the cone.

The same manner, the section of a cylinder may be found by drawing lines parallel to the middle line G, instead of being drawn to the point D. The truth of this method may be conceived by raising the plane Y upon IP, so as to be perpendicular to the plane X; then turning the plane Z at a right angle with the plane Y, so that I n will fall upon I N, the point E will be the apex of the cone; then, if a set of planes be supposed to pass through the axis parallel to the intersecting line, and another set of planes to pass through the plane parallel to IP, and both sets through the same points (a, b, c, d, e, f, g, h) of the original figure; it will be evident that these planes will cut the sectional plane by their intersections with each other in the points, a, b, c, d, e, f, g, h.

Fig. 5. is an example of this method in a right cone, in which only one half of the section is shown.

Fig. 6. is an example in a cylinder, which only differs from the cone in the planes being parallel. Having found the middle line GD, and E, as in the description of fig. 4, from the points of section in IP, draw a line parallel to GD, to cut IE: from the points of section in IE, draw lines parallel to I n, cutting n E: from the points p, g, b, d, e, f, c, of section in n E, and upon the lines parallel to I n, make p b, p m, equal to p b or p m: make p c, p l, equal to p c or p l: make p d, p k, each equal to p d or p k: make p e, p l, each equal to p e or p l: make p f, p b, each equal to p f or p b; then the points a, b, c, d, e, f, g, h, the extremities of the diameter, are the sections of the extremities of the plane passing through a, b, and consequently abedfgbiklm is the section of the whole figure.

Fig. 7. shows the section by the same general method, when the cylinder is a right cylinder.

PROB. V.

Given the plane X, the facts A, B, C, (fig. 8.) in the plane X, of three points on the surface of another plane Y in space, and the heights of the points in the plane Y, above the given plane X; to find the intersect of the plane Y with the plane X.

Draw the three parallel lines A D, B F, C E, through the points A, B, C: make A D equal to the height of the point whose fact is A; B F equal to the height of the point whose fact is B; and C E equal to the height of the point whose fact is C: join A C, and produce it to H; join D E, and produce D E to H; draw B G parallel to A H, and F G parallel to D H, and join G H; then will G H be the intersect of the plane Y upon the plane X.

Demonstration.—Suppose A D perpendicular to A H, and consequently B F perpendicular to B G; then let the plane A D H be raised upon H to A H: the plane becomes perpendicular to the plane X; and at the same time let the plane B F G be raised upon G B, until it becomes also perpendicular to the plane X: then, because the triangle B F G is similar to the triangle A D H, and since both the planes A D H and B F G are perpendicular to the plane X, and their intersections A H and B G, with the plane X, are parallel, F G will be parallel to D H; and because A D and C E are perpendicular to A H, A D and C E will be both perpendicular to the plane X, and for the same reason B F is perpendicular to the plane X: therefore the points A, B, C, in the plane X, are the seats of the three points D, F, E, raised to the plane Y; and because F G and D H are parallel, all the points in F G and D H are in the plane Y; therefore the points G and H, which are common to the plane X, and to the lines D H and F G, are also in the plane Y; and because the points G and H are common to both the planes X and Y, therefore the straight line G H is common to the planes X and Y; whence the straight line G H is the intersect of the planes X and Y.

PROB. VI.

Given the seats A, B, C, (fig. 9,) of three points on the curved surface of the segment of a right cylinder in the plane of the base X, and the heights of the points; to find the section of the cylinder.

Find the intersect G H, X, in the fifth problem; let AC be the base of the plane of the segment, which is perpendicular to the plane X: draw A I and C K parallel to G H; and draw C L perpendicular to A I, cutting A I in L; make L I equal to the height upon the point A, and K E equal to the height upon the point C; and join I K. In the base A B C take any intermediate points a, b, c, d, e; and draw the lines a f, b g, c h, d i, e k, meeting I K at f, g, h, i, k: through the points f, g, h, i, k, draw f a, g b, h c, i d, k e, each perpendicular to I K: make I A, f a, g b, h c, i d, k e, respectively equal to L A, f a, g b, h c, i d, k e: join A K, and draw the curve A b c e f k, and A b c e f k A will be the section of the cylinder, as required.

Demonstration.—Imagining a series of planes to pass through the points A, b, c, d, e, C, parallel to G H, and perpendicular to the plane X of the base; also a plane to pass through L C perpendicular to the said plane X; then all these planes will be parallel to the axis of the cylinder, and the plane standing upon L C will be perpendicular to the planes passing through the points A, b, c, d, e, C, as well as to the intersect of the plane X and Y. Suppose, therefore,
The idea of stereotype printing is not of modern origin. That it was prior to the art of printing by moveable types there can be no doubt, since this latter mode of printing was first suggested by the Catholicon, which was printed with wooden tablets, in a series, and composed in forms. This mode of printing, except in China, where it is still practiced, was laid aside soon after the invention of the common letter-press printing.

The history of the modern stereotype is involved in some obscurity. In the Philosophical Magazine is the following account: "Above a hundred years ago, the Dutch were in possession of the art of printing with solid or fixed types, which were in every respect superior to that of Didot's stereotype. It may, however, be easily understood, that their letters were not cut in so elegant a manner, especially when we consider the progress which typography has made since that period. Samuel and J. Leuchtmans, bookellers at Leyden, have in their possession the forms of a quarto bible, which were constructed in this ingenious manner. Many thousand impressions were thrown off, which are in every body's hands, and the letters are still good."

The inventor of this useful art was J. Vander Mey, who resided at Leyden about the end of the 16th century. With the assistance of Muller, the clergyman of the German congregation there, who carefully superintended the correction, he prepared and called the plates for the above-mentioned bible, in 4to. This bible was published likewise in folio with large margins, ornamented with figures, the forms of which are still in the hands of Elwe, a bookseller at Amsterdam; also in an English New Testament, and Schap's Syriac Dictionary, the forms of which were melted down; likewise a small Greek Testament, in 18mo. As far as can now be ascertained, Vander Mey printed nothing else in this manner; and the art of preparing solid blocks was lost at his death, or at least was not afterwards employed."

The Dutch editor supposes, that the reason why Vander Mey's invention was dropped was, that the process was too expensive.

In the year 1781 was printed, by Mr. Nicholas of London, a pamphlet, entitled "Biographical Memoirs of William Ged," including a particular account of his progress in the art of block-printing. The first part of the pamphlet was printed from a MS. dictated by Mr. Ged just previously to his death: the second part was written by his daughter, for whose benefit the profits of the publication were intended: the third is a copy of proposals issued by Ged's son, in 1751, for reviving his father's art; and to the whole is added Mr. More's narrative of block-printing.

It should seem from this publication, that in the year 1755, Mr. Ged began his scheme of block-printing. In 1777 he entered into a contract with a person who had a small capital, but who, alarmed at the supposed risk of losing the little which he had, abandoned the concern, after he had expended little more than twenty pounds. In 1729 he entered into a more promising partnership with a Mr. Fenner, Mr. Thomas James, a type-founder, and John James, an architect. Some time after a privilege was obtained from the university of Cambridge to print bibles and prayer-books; but it appears, that one of his partners was actually averse from the plan, and, to thwart the project, engaged such people for the work as he thought most likely to spoil it. One of his people who was entrustted with the secret, avowed, that all the books printed in stereotype had been purposely made incorrect, in consequence of which they were fuppressed at the university, and the plates sent to the king's printing-house, and thence to Caldon's foundery. "After much ill usage," says the writer.
STEREOTYPE.

writer in the Philosophical Magazine, "Ged, who appears to have been a person of great honesty and simplicity, returned to Edinburgh. His friends were anxious that a specimen of his art should be published, which was done by subscription. His son James, who had been apprenticed to a printer, with the consent of his master set up the forms in the night-time, when the other compositors were gone home, for his father to cast the plates from, by which means the first was finished in 1736." A copy of this work is in Mr. Tilloch's possession, and also a plate of one of the pages from which it was printed. Another work was also printed from plates manufactured by Mr. Ged; this was the well-known book entitled "The Life of God in the Soul of Man," which has the following imprint: "Newcastle, printed and sold by John White, from plates made by William Ged, goldsmith in Edinburgh, 1742."

Fifty years after the invention of plate-printing by Mr. Ged, Mr. Tilloch tells us he made a similar discovery, without having at the time any knowledge whatever of Ged's invention. He was aided in bringing his discovery into practice by Mr. Foulis, printer to the university of Glasgow. They overcame every difficulty, and were able to produce plates, the imperfects of which were as perfect and handsome as those of the types from which they were cast. Though we have reason to fear, says Mr. Tilloch, from what we were told, that our efforts would experience a similar opposition, we persevered in our object, and took out patents for England and Scotland, to secure to ourselves, for the usual term, the benefits of our invention; for the discovery, he adds, was as much their own, as if nothing similar had been practiced before. Ged's knowledge of the art may be laid to have died with his son, whose proposals for reviving it, published in 1751, not having met with encouragement, he went to Jamaica, where he died. Owing to circumstances of a private nature, not at all connected with the stereotype art, the business was laid aside after some few volumes had been stereotyped and printed under the direction of Meffra of Tilloch and Foulis.

Some time elapsed, when M. Didot, a French printer, applied the stereotype art to logarithmic tables, and afterwards to several of the most popular classics, such as Virgil, Horace, &c. and to various French publications. On this account, the French lay claim to the invention, but surely without even the appearance of justice. About the year 1800, Mr. Wilson, a printer in London, manufactured, after the directions of Mr. Ged, an apparatus for bringing the stereotype art into general practice. His lordship is said to have had some communications with Mr. Tilloch on the subject, and afterwards to have received the personal attendance of Mr. Foulis at his seat, at Chevening, in Kent, where the noble earl was probably initiated into the practical part of the operation, and for which, he has heard, he paid 700£ as a remuneration.

After some years application, Mr. Wilson, who at that time lived in the neighbourhood of Lincoln's-Inn-Fields, but who afterwards removed to St. Pancras, and carried on the business on a very extensive scale, announced to the public, that the genius and perseverance of earl Stanhope had overcome every difficulty; and that accordingly, the various processes of the stereotype art had been so admirably contrived, combining the most beautiful simplicity, with the most desirable economy, the ne plus ultra of perfection, with that of cheapness, as to yield encouragement to the public for looking forward to the happy period when an application of this valuable art to the manufacture of books would be the means of reducing the price of all standard works, at least thirty, and in many cases forty, per cent.

In 1804, Mr. Wilson offered, upon certain terms advantageous to himself, the stereotype art to the university of Cambridge, for their adoption and use in the printing of bibles, tellaments, and prayer-books. Some differences between the syndics and the printer caused the contract to be dissolved. Into these disputes it is not our business to enter; it will be sufficient to add, that at present, at Oxford as well as at Cambridge, the stereotype art is adopted, and thousands of bibles, &c. die annually from their presses, printed on that plan.

The practice of stereotype printing is readily described: a page of any work is set up in the usual mode of printing, (see the article Paravision) from which a mould of plasters, similar to plasters of Paris, is taken off, and from this a plate in type metal, from which the stereotype print is worked. Of course the whole is set up in distinct pages, which are to be put together in the usual way before a sheet is worked at press.

It is evident, therefore, that the beautiful specimens of stereotype printing sometimes exhibited, and which have induced many persons to ascribe that merit to the art, does not in reality belong to it. A stereotype printing is a fac simile of the page from which it was taken, and consequently cannot exceed in beauty the original. Stereotype, therefore, can give no additional beauty to printing; this depends on the taste of the letter-founder, and the care of the compositor. Those who produce fine specimens of stereotype printing, could also give others equally good with the moveable types from which the plates are cast.

The metal of which the plates are to be cast is a compound of regulus of antimony and hard lead, or sea-cheet lead. The general method of mixing the metal is to take one hundred weight of regulus of antimony, and break it into small pieces, separating from it all dust and dirt, and then add to it from five to eight hundred weight of hard lead, according as the metal is required to be more or less hard. The lead is to be melted over a flow fire, and when melted, and the scum taken off, the regulus is to be put in. To every hundred weight of lead may be added a pound or two of block-tin, but this is not necessary.

In casting the plates, as in every other casting, a mould must first be made, so as to form the counterpart of the original type. The substance required for this must be of oxide of lead, a little twisted, to deliberate a texture when soft, as to be capable of receiving an impression from the finest lines: and when dry, it must be capable of bearing the action of melted metal. These qualities will be found in gypsum or plaster of Paris. Gypsum in the rock, as it is called, which is the best, is plentiful in Nottinghamshire. It has been observed, that this substance, when pulverized and mixed with water, soon becomes very hard, and will bear almost any degree of heat; but it contracts when exposed to fire, and is liable to warp. It is also extremely difficult to expel the air and moisture which it rapidly absorbs, and tenaciously retains. These are defects respecting the processes of casting, which require to be corrected by compounding it with other substances less absorbing than itself. But whatever be added to it must be capable of a fine surface, so as to preserve a perfect polish on the plate to be cast. The following process has been recommended: dissolve a quantity of common whiting in a tub of clean water, and make it of the consistence of what is generally used in white-washing. Mix the plaster with this solution, and it will contract but little from the heat; the air and the moisture will be expelled with greater ease.
and the mould will not be so liable to crack as the plaster would alone.

In making a perfect mould for the page to be cast, a frame of cast-iron must be prepared, nearly half an inch wider and longer than the page or pages locked up in the chases. The frame determines the thickness and strength of the mould, and requires to be nearly an inch deep. To this frame are added four cubic pieces of metal, whose height should be exactly four-fifths of the height of the letters. On the height of these, the thickness of the stereotype plate depends. The pages in the chases are now to be laid flat upon the moulding table, and the letter, if necessary, to be planed down to a flat surface. In the openings of the four corners of the page are to be placed the four pieces of metal, on which the frame is to rest when laid over the page.

To prevent the adherence of the plaster, it will be necessary to oil the face of the page with a soft brush; then take a quantity of the white-wash into a wooden bowl, and add to it so much fine plaster as will make it into a thin paste. When reduced to an equal consistency, apply it to the face of the letter with a letterer’s brush, so as to fill every cavity, and then pour on the remainder of the plaster to fill the frame. When beginning to harden, strike off the superfluous plaster with a slanting metal rule, and the back of the mould will be smooth and regular. The mould is next to be separated from the page, and to be dried in an oven.

In casting the plates, the dried mould is to be laid in a pan about two inches deep, with the face upwards, and a small movable screw is to be placed at each side or end of the pan to furnish a press on the frame which contains the mould, and prevent the rising up, and the metal is applied over the mould in the pan, and carried to the oven, in which it should remain from one to two hours, to acquire an equal degree of heat; for on the principle of equal temperature between the metal and moulds, the success of the operation wholly depends. And unless the oven be kept sufficiently hot to raise the temperature of the moulds to that of the melted metal, the experiment cannot succeed.

Such is the fineness of the composition of the moulds, and the accuracy of the process, that plates may be cast from the finest engravings as perfectly as the copper-plate itself, and might be worked in the same manner, could it be cleaned after each operation with the same facility, and if the metal did not discolour the paper. Wood-cuts, ornaments, &c. are cast in the same manner, perfectly correct. The art has also been applied to the printing of music.

When the pages are returned from the foundery, they require to be thoroughly cleaned; for if the oil be suffered to remain on the letter, it will not only be disagreeable to distribute and compose, but the dirt which adheres to it will spoil the next mould to be made from it; hence it is necessary that the letter be thoroughly cleaned with boiling water and a brush, which increases the expenses attached to this art very considerably.

After a plate has been cast, a few small imperfections will frequently be discovered; such as that the eye of the e, or similar letters, may have been full of dirt when the mould has been taken; or of course the plate will exhibit those parts filled with metal, which now require to be corrected. A workman, called a picker, takes the plate, and after clearing it of all superfluous metal, pulls a proof, marks the defects, and proceeds to make the requisite alterations in a manner that will now be easily understood. If, in the course of the work, any damage be done to the plate, or any letter or word be broken, the picker cuts it out, and inserts in its place a moveable type. This is very practicable, and only requires the letters to be cut square, so that the type may exactly fit the place. In this way a letter, a word, or even a line, may be taken out and corrected without injuring the plate. The plate is now ready for the press, and may be laid on blocks, and fastened down with a slip of brass and a screw.

With respect to the advantages to be obtained by the stereotype over the common mode of printing, it may be observed, that the calculations of Mr. Wilton, already referred to, of an actual saving of 30 or 40 per cent. seem to have been much over-rated. Mr. Brightly, who practised the method of stereotype for some years, having made several estimates, and being himself a printer as well as publisher, could have no inducement to give an exaggerated statement on either side of the question, seems to doubt if there be any saving whatever by the new process. Among others, he has given the estimate of the expenses of a work printed in both ways, equal to twenty sheets octavo, of which 1000 copies are fold annually. Here he assumes, that in the common mode, the 4000 copies must be worked at once, but according to the stereotype plan, 500 copies are to be worked every six months, to save the interest of money. Supposing the paper in both cases to be thirty shillings per ream, the calculation is as follows:

<table>
<thead>
<tr>
<th>Price of Common Printing.</th>
<th>£</th>
<th>s</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>-</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Reading</td>
<td>-</td>
<td>3 10</td>
<td>0</td>
</tr>
<tr>
<td>Press-work</td>
<td>-</td>
<td>24</td>
<td>0</td>
</tr>
<tr>
<td>Other expenses and profits</td>
<td>-</td>
<td>43 10</td>
<td>0</td>
</tr>
<tr>
<td>One hundred and sixty reams of paper</td>
<td>62</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Interest of money for the first half year</td>
<td>7 11</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ditto for the second half year</td>
<td>6 12</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Ditto for the third half year</td>
<td>5 13</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Ditto for the fourth half year</td>
<td>4 14</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Ditto for the fifth half year</td>
<td>3 15</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Ditto for the sixth half year</td>
<td>2 16</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Ditto for the seventh half year</td>
<td>1 17</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Ditto for the eighth half year</td>
<td>0 18</td>
<td>10 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>336</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price of Stereotype.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition, allowing one-fifth extra (see above)</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Press-work for five hundred copies, fourth extra</td>
</tr>
<tr>
<td>Other expenses and profits</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Casting plates</td>
</tr>
<tr>
<td>Twenty reams of paper</td>
</tr>
<tr>
<td>Interest for six months</td>
</tr>
<tr>
<td>Carry over</td>
</tr>
</tbody>
</table>
Brought forward  
Cost of the first five hundred, second, and  
of each subsequent five hundred, will be  
38l. 5s. 3d.  
} 267 16 9

Common printing  -  -  -  -  -  -  -  386 17 2
Balance against stereotype, after four years  
50 13 3

The next edition of four thousand copies  
by common printing will cost as before  336 4 6
Ditto on stereotype eight times 38l. 5s. 3d.  
306 2 0
Balance in favour of stereotype in the  
second edition  -  -  -  -  -  -  -  30 2 6

Hence it appears, that it will require more than ten years  
to clear the expense of the plates only, and after that it will  
yield a profit of 3ol. 2s. 6d. on every subsequent edition of  
4000 copies.

From the foregoing estimate, and several others given by  
the same author, which are not more favourable to the new  
mode of printing, other advantages must be looked for than  
those which result from pecuniary savings; but new discoveries  
can render the process more economical than it is at present;  
thus, if the pages could be set so true, that they  
might go to press, and be worked with the same ease and  
expence as moveable types; and if a substitute could be  
found for oiling and brushing the pages so as not to wear  
the type, or increase the labour of the compositor, more  
decided advantages would result from the introduction of  
stereotype: such as the following.

1ft. On books published in parts or numbers. Purchasers  
frequently take in the early parts and leave off; by which  
the sets become broken and uneven, and a great loss is incurred  
by the waffle of paper. This might be prevented by stereotype,  
which so remarkably facilitates the perfecting any  
parts or numbers that are found deficient.

2dly. On new books of doubtful sale. The plan of casting  
plates would not involve an expense of more than sevenpence  
for an octavo page, besides the metal, which will still retain  
its value. So that a hundred, or a less number of copies,  
might be struck off to ascertain the opinion of the public.  
If it did not sell, the loss on a work of 20 sheets would  
not be more than about 8s., besides the composition; but if 500,  
or 750 copies were printed in the common way, and not, fold,  
the loss would be from 3ol. to 4ol.

3dly. The principal advantage is unquestionably on rock  
books, whether bibles, prayer-books, or school-books,  
particularly works of arithmetic, and other branches of mathematics.  
These, by means of the stereotype, may be brought  
to perfect accuracy; and having once attained to that standard,  
may be kept to without the possibility of deviation; for  
this excellence, the public would not grudge even an extra  
price.

STEREOXYLON, in Botany, fromStereos, hard and  
and xylon, wood, a name given by Ruiz and Pavon in  
their Flora Peruana, to the genus which had long before  
been called by Linneaus Escallonia, (see that article,)  
in honour of one of their distinguished botanical countrymen.  
Of this prior appropriation of the genus, they seem not to  
have been aware. Poiret, however, in Lamarck's Dictionary,  
v. 7. 434, has followed their error, and described eleven  
species of the genus in question, all natives of Peru or Chili,  
in cold, moist, shady, sometimes very elevated, situations.

Their habit is shrubby; their leaves simple, more or less oval  
or obovate, finely or coarsely ferrated; flowers white or red,  
sometimes fragrant; young branches, and buds, often refrin-  
ous, aromatic, or bitter.

STERILE LANDS, in Agriculture, those sorts which are  
unproductive in consequence of their particular nature and  
qualities; or which contain only small portions of nutrient  
substances in their compositions.

In the examination of the constituent parts or matters of  
sterile lands, in the intention of ameliorating and improving  
them in regard to their fertility, any sort of component  
material, which is known as a cause of barrenness or unproductive  
properties, should be well and carefully attended to and  
considered; and if the whole of their composition can be nicely  
compared with that of some good and productive lands, in  
nearly the same situation and vicinity, the differences in  
the component substances of them may, in different instan-  
ces, point out the most proper and ready methods of  
improving them.

Where lands of this sort become so in consequence of  
their too stiff clayey nature, they may be improved and  
brought into a productive situation by the use and applica- 
tion of sandy, earthy, calcareous, marly, and other similar  
matters. Where lands are deficient in fertility, on account of  
their abounding too much in calcareous matter, they may be  
greatly improved and rendered more fruitful by the putting  
of sandy or clayey materials upon them. Where lands are  
unproductive, in consequence of abounding too much in  
fandy matters, they may be improved in their texture  
and other qualities, as well as rendered more capable of  
producing good crops, by the applying clay, clayey marl,  
and earthy vegetable materials to them. The application of  
peaty or turfy matters over the surfaces of light burning  
fandy lands, has been found to be attended with immediate  
and permanent good effects in many instances. Where lands  
are sterile in nature, from containing too great quantities  
of ferruginous, ochry, or saline, iron, and acid matters  
in their compositions, they may be greatly benefited in their  
productive properties by the use of quicklime in suitable proportions.  
In lands of otherwise good qualities and textures, which were  
sterile from containing too large proportions of the  
phosphate of iron, it has been found that they have been rendered  
productive, by having quicklime laid over the surfaces of  
them, as that substance has the property of converting this  
fort of phosphate or vitrified iron into a manure, which  
serves as the food of the plants upon them.

Where lands become infertile from the deficiency of earthy,  
vegetable, or animal matters, the obvious means of removing  
it is the free use of suitable substances of the manure kind  
in proper proportions. Where the excess of vegetable or  
other such matters causes improprieties in the growths of  
the crops, it is capable of being reduced readily by the  
practice of burning, or of being altered and improved by the  
suitable application of proper earthy materials of different  
kinds.

Where boggy, peaty, moony, or marshy lands are to be  
improved in their fertility and productive properties, the first  
steps to be taken for the purpose are most safely of properly  
cultivating, and laying aside the superabundant moisture or wet- 
ness, both of which greatly contribute to these defects; and  
the latter promotes the growth of all sorts of nourishing kinds  
of plants, by the removal of injurious stagnant moisture.  
Some soft black peaty kinds of land, which have undergone  
this last operation, are not unfrequently rendered fertile and  
productive, merely by the application of sandy or clayey  
matters over their surfaces in due proportions; and repeating  
them as there may be a necessity. Where such peaty  
lands
lands are of a four acid nature and quality, or contain ferruginous, ochry, and saline matters, the use of lime, or other calcareous materials in sufficient quantity, is indispensably necessary for bringing them into a proper state of culture, and for rendering them productive, either in the arable or grazed state. When they abound with ligneous matters, and different coarse vegetable products, which prevent their being made productive, they are to be removed or reduced by burning the superficial parts; in which last case, the ashes thus afforded may supply earthy materials suited to the improvement of the texture and other qualities of such lands.

In short, in this business the farmer should constantly follow, as much as he possibly can, the lefens and methods held out to him by nature, in her means of improving different lands of this sort; and the result of his labours will be the rendering them permanently more beneficial by their increased fertility; by their requiring less expense in drellings afterwards; and by the value of the lands being for ever after greatly augmented.

The particular nature and causes of sterility in lands, have been stated and explained in speaking of soils. See Soil.

STERILITY, formed from sterilitas, of sterilis, barren, the quality of a thing that is barren; in opposition to fructifery.

Sterility was held a grievous affliction by the wives of the ancient patriarchs. Nature has annexed sterility to all monstrous productions, that the creation might not degenerate. Hence the sterility of mules, &c.

Women frequently become sterile after a miscarriage, or a difficult labour, by reason the uterus, or some other of the genital parts, are injured thereby.

STERIPHIA, in Botany, so named by Dr. Solander from ςεμφος, in allusion, perhaps, to the mean and dry integument of its fruit, which, though at first sight resembling a berry, proves unprofitable, in that respect, to the gatherer.

—Gent. v. 2. 81. t. 94.—Clavis, and order, Piantandra Dijymia.

This is no other than Dichondra of Forster. (See that article.) Garrant speaks of it as a very difficult and singular genus, having the habit of Stilborphia europaea, but in the number of its parts of fructification, nearly agreeing with Schrebarea. Now it happens that the Schrebarea alluded to is, as we have said in its proper place, merely a Cucuna, growing on a Myrica. Whether Solander or Garrant made this allusion to it, they could only have in view its artificial characters and place in the Linnaean system, for the plant itself was, at that time, unknown to them.

STERIS, a Linnaean name, of whose meaning or application we have no information; nor is it a matter of any consequence, the plant which bears this name, S. javana, Linn. Mant. 8. and 54, being the same with Nama acyanica, Linn. Sp. Pl. 327, and in fact a species of Hydrolea. See that article; fp. 4.

STERKEL, J. F. X. Ahati, in Biography, first chapelmaster to the elector of Meinz, was born at Wurtzburg in 1743, went into Italy at the expense of his patron in 1761, where he chiefly resided at Rome and Naples, in which cities he was much esteemed for his amiable character. He formed his style on the taste of the Italian school, to which he has constantly adhered.

Besides many compositions for the harpsichord and piano forte, which he produced in Italy, he composed at Naples the opera of "Farace."

In 1782 he returned to Germany, and the next year published at Vienna, we think his best and most pleasing work, "Six Sonatas for the Piano Forte or Harpsichord, accompanied by a Violin and Violoncello obligato, dedicated to his most eminent Highness the Elector of Mayence. Op. XVII." These sonatas, when well accompanied, are extremely interesting and amusing. The abbé Sterkel there, as in all his compositions for keyed instruments, has manifested that he did not visit Italy unprofitably; his productions, though not very laboured or learned, are full of spirit, taste, and pleasing passages; and he has not only collected all the vocal flowers of the greatest opera-fingers of the present times, but scattered them liberally through his works. His violin accompaniments generally confit of passages of effect, and such as give importance to the player. Indeed his pieces, though not very original, are left tinted with Bachins, or Haydnins, than those of his countrymen who have not visited Italy; and though less solid, and less his own property than those of many modern composers, yet they are more easy to execute, and more intelligible to unlearned readers. We have been afforded by some of his scholars, that he played on the clavichord and piano forte, with such taste, expression, and cleverness, as few performers, except Emanuel Bach, ever arrived at.

STERLING, a term frequent in the English commerce. A pound, shilling, or penny stierling, signifies as much as a pound, shilling, or penny, of lawful money of England, as settled by public authority.

Antiquaries and critics are greatly divided as to the origin of the word stierling. Buchanan fetches it from the castle of Strielving, or Stirling, in Scotland, where a small coin was anciently struck; that in time, according to him, came to give name to all the rest. Camden derives the word from stierling, or stierling; observing, that in the reign of king Richard I. money coined in the east parts of Germany began to be of especial request in England by reason of its purity, and was called stierling money, as all the inhabitants of those parts were called stierlings; some of whom, skilled in coinage, were soon after, vis. in the reign of king John, sent for over to pervert the English money, or reduce it to its due fineness, which was thence forwards denominated from them, stierling, or stierlings; not, says Camden, from Strielving in Scotland, nor from Stellas, a star which some dream to have been coined upon it; for in old deeds, the English species are always called nummi stierlingus, which implied as much as good and lawful money, &c. Clarke, in his Connexion of the Roman, Saxon, &c. Coins, p. 80. observes, that the Saxon or English pound was called the pound stierling, because their ancestors brought it from the most eastern parts of Europe, the shores of the Euxine; and that they called it libra stierlingorum, the pound stierling or stierling; to distinguish it from the Roman pound, which, to preserve the same distinction, was called libra accita, or the western pound. Somner, again, derives the word from the Saxon stiora, a rule or standard; intimating, that this, as to weight and fineness, was to be the common standard of all current money.

In Stow, and some other of our ancient writers, stierling, or stierling, is also used for a certain coin, in value amounting nearly to our silver penny; and on some occasions we find the same word stierling used in the general for a piece of money, it being observable, that for a good while together, there was no other coin but pennies, with which stierlings or stierlingers were become synonymous; much as, among the ancients, the words demarius and nummus were used.

STERLING, in Geography, a plantation in Kennebec county,
STE and state of Maine, N.W. of Hallowell.—Also, a township of Connecticut, in Windham county, 44 miles E. of Hartford; containing 1101 inhabitants.—Also, a township of Franklin county, Vermont, containing 122 inhabitants.—Also, a town of Worcester county, in Massachusetts, incorporated in 1781, and containing 1472 inhabitants; 62 miles N.E. from Worcester.

STERLINGVILLE, a post-town in Granville county, North Carolina; 467 miles from Washington.

STERLITAMATZK, a town of Russia, in the government of Upha. N. lat. 54° 40'. E. long. 55° 54'.

STERN of a Ship, denotes her posterior face; or that part which is presented to the view of a spectator, placed on the continuation of the keel behind. It is terminated above by the taffarel, and below by the counters: it is limited on the sides by the quarter-pieces; and the intermediate space comprehends the galleries and windows of the different cabins.

STERN, among Hunters, is the tail of a wolf, or a greyhound.

STERN-CHASE. See CHASE.

STERN-FALL, aboard a Ship, some fastenings of ropes, &c. behind the stern of a ship, to which a cable or hawser may be brought or fixed, in order to hold her stern to a wharf, &c.

STERN-FRAME, in Ship-Building, the strong frame of timber, composed of the stern-post, transoms, and fashion-pieces, which forms the backs of the whole stern.

STERN-LADDER, are made of rope and rope-nails, and hang over the stern of ships, to come on board by in very rough weather.

STERN-MAST, in Sea Language, usually denotes that part of a fleet of ships which is in the rear, or farthest a- stern, as opposed to head-mast.

STERN-POLE, in a Ship, a great timber let into the keel at the stern of a ship, somewhat sloping, into which are fastened the after-planks; and on this pole, by its pintel and gudgeons, hangs the rudder.

It is usually marked, like the stem, (which see,) with a scale of feet from the keel upwards, in order to ascertain the draught of water at that part of the vessel. The difficulty of procuring a stern-post of sufficient breadth in one piece, has introduced the practice of fixing an additional piece behind it, which is strongly bolted to the former. The hinges, which support the rudder, are accordingly fixed to this latter, which is also tenoned into the keel, and denominated the back of the pole. It is half the breadth of the stern-post at the keel, but diminishes gradually towards the upper end, where it is one-third narrower. The stern-post is strongly attached to the keel by a knee, of which one branch extends along the keel, being scarfed and bolted to the dead-wood, and fore-locked under the keel, while the other branch inclines upwards, and corresponds with the infide or fore-part of the stern-post, to which it is also bolted in the same manner. Falconer.

STERN-SHEETS, that part of a boat which is contained between the stern and the aftmoat, or hindmost part of the rowers. It is generally furnished with benches to accommodate the passengers. Falconer.

STERN-WAY, in Sea Language, the movement by which a ship retreats, or falls backward, with her stern foremost. See WAY.

STERNA, in the Tern, in Ornithology, a genus of birds of the order Anseres, of which the generic character is: Bill fumbulate, straitish, pointed, a little compressed, without teeth; nostrils linear; tongue pointed; wings very long; tail mostly forked. Twenty-five species of this genus are enumerated by Gmelin: they are mostly inhabitants of the ocean, and feed on fishes. Many of them are found on the shores of large lakes and rivers. Four of the species are common to our own country. They breed among small tufts of rushes, and lay three or four eggs of a dull olive colour, spotted with black. The birds belonging to this genus are at all times clamorous and gregarious, but more particularly in the spring of the year, during the time of nestling. At this period they assemble in large flocks, and their activity seems greatly increased, for they repeat with eagerness their sharp piercing notes so incessantly, that persons cannot approach the place where they breed without being almost stunned with their noise. With us the terns are migratory, leaving our shores regularly on the approach of winter.

Species.

CASPIA. The Caspian tern has its body above of a plumeous ash; beneath and neck white; the bill is scarlet; the frontlet and legs are black. It is found, as its specific name denotes, on the Caspian sea, and is nearly two feet in length. It frequents the sea-shores and banks; feeds on small fish and sea-infusoria, hovering over the water, and suddenly darting into it for its prey. The bill is red; irides dusky; tail short, forked; quill-feathers tipped with black; the legs are brown. There are three varieties: 1. Crown black, spotted with white; tail-feathers with brown bars. It inhabits Bombay, and is twenty-one inches long; its bill is red; and legs black. 2. Crown black; hind-head sub-crested; outer tail-feathers white from the middle to the tip; the bill is yellowish; and the legs black. It inhabits China, and the Sandwich islands. 3. The bill in this is white; frontlet varied black and white; ears black; back and wings cinnereous; quill and tail-feathers tipped with black.

CAYANENSIS; Cayenne Tern. Cinerceous; the feathers edged with reddish; beneath they are white; the hind-head is black. It inhabits Cayenne, and is sixteen inches long.

SURINAMENSIS; Surinam Tern. Bill, head, neck, and breast, black; back, wings, and tail, cinerceous; belly whitish; legs red. It inhabits Surinam, and is about fifteen inches long.

FULIGINOSA; Sooty Tern. Black; beneath, cheeks, front, and shafts of the quill and tail-feathers, white. It inhabits the Atlantic and Antarctic seas, and is fifteen inches long. The bill and legs are white; the eggs yellowish, with brown and violet spots; outer tail-feathers white, except at the tip.

AFRICANA; African Tern. White; bill and legs black; crown, wings, and tip of the tail, spotted. It is an African bird, and is about the size of the 8. fuliginosa. The crown is spotted with black, the wings with brown, and the tail with white; quill-feathers blueish-ash.

STOLIDA; Noddy. Body black; front whitish; eyebrows black; bill and legs black; the hind-head is cinnereous. It is fifteen inches long; found chiefly within the tropics; is clamorous; seldom goes far from shore, and always rests at night. It builds on rocks; and its eggs are excellent food.

PHILIPPINÆ; Philippine Tern. Claret-grey; cap white; band through the eyes, wings, tail, bill, and legs, black. It is found on the shores of the Philippine islands; and is about twice as large as the common fawnanor.

SIMPLEX; Simple Tern. Above plumbeous; beneath, crown,
STERNA.

crown, greater and middle wing-coverts, white; band behind the ears and quill-feathers black. A variety has the bill and legs black. It inhabits Cayenne; and is fifteen inches long. The bill and legs are red; some of the wing-coverts edged with brown.

NITOTICA; Egyptian Tern. Cinereous; beneath white; head and neck with blackish spots; orbits black, dotted with white. It inhabits Egypt; and is above the size of a common dove. The bill is black; and the legs of a flesh colour.

* CANTIACA; Sandwich Tern. White; back and wings hoary; cap black; front with white spots; quill-feathers blackish, with a white shaft. The bill is black, but yellowish at the tip; the legs are black; wings longer than the tail; the egg is of an olive-brown, purplish and crowded spots; it is full eighteen inches long, and is found on the Kestrel coast, generally appearing about Romney in the middle of April, and leaving the country in September. It is rather common at Sandwich, where it was first noticed by Mr. Boys. There are two varieties of this species: 1. Tail hardly forked; body variegated; ears with a black spot. 2. Above black, varied with paler colours; beneath white; tail forked; bill and legs black. This last is found in Finland.

* HIRUNDO; Common, or Greater Tern. The two outer tail-feathers are half black and half white. There is a variety that has black legs, outer tail-feathers entirely white. The greater tern is about thirteen inches from the tip of the bill to that of the toes; its breadth, when the wings are spread, is about two feet. It is of a slender form, but elegant, with the beautiful plumage which is adorned. The back is covered with a grey mantle; the breast is of pure white, richly contraltered with a large black spot upon the crown of the head, resembling a hat; the bill and legs are red. Early in the spring this species arrives on our own coasts, and sometimes is seen a considerable way from the shore, in the interior parts of the country, hovering about the lakes and rivers. They are observed by sailors during the whole passage from Britain to Madeira. They are the most active fishermen of all the aquatic tribes; inoffensively darting upon the prey which they observe from a great height in the air. After having dived and caught the booty, they as suddenly rise again to their former elevation.

The action of the stomach which this tribe exhibits is amazingly powerful; the fish being so completely digested in an hour, that they are ready to swallow a new meal. Those parts of the food that are nearest the bottom of the stomach are disolved, and make way for the reff, which soon undergoes the same process.

Immediately after the arrival of this species of the tern, the pairing season commences; during which each female chooses a warm bed of sand, where the deposits three eggs, of a size far superior to what might be expected from a bird of her dimensions. The eggs of the tern are of different colours, fome grey, others brown, and some of a greenish hue. The manner in which their eggs are hatched is as singular as their external appearance, for it is accomplished chiefly by the heat of the sun. If the weather be dry and warm, the female seldom hatches by day, but resumes her maternal functions regularly about the time that the influence of the sun begins to decrease.

The young are not all protruded at the same time, but in the order in which the eggs were laid; and at the interval of a day between each of the three birds. The young terns leave the nest, and follow the parent bird, who supplies them with small morrels of the fish upon which they themselves feed. During the whole period of incubation, the parent birds display great solicitude for the safety of their eggs and their young. Should a peril at this period approach their nest, both parents dart down from the air, and flutter about him, uttering all the while the most piercing screams, expressive at once of their fear, anxiety, and rage. These paternal cares soon cease; the young foons become capable of pecking their own food when provided for them. For a few days they are fed by the mother's bill; afterward, what food the parents provide, they swallow without even alighting upon the ground. Fond of indulging in their aerial excursions, they drop down the food upon their young, that are waiting below to receive it.

Terns are provided with very large wings, and from this circumstance the young are not soon able to fly, their wings not being strong enough to accommodate them for flight. In this circumstance they resemble the swallow, which remains longer in the nest than any bird of its size, and leaves it more completely feathered. During this period of nonage, the parent terns continue to shower down plentiful supplies of food to their young, who at a very early period begin to dispute for their prey, displaying that infatuable gluttony which characterizes their race. The colour of the first plumage is a whitish-grey; the true colour is not obtained till after the first molting.

PANAYENSI; Panayan Tern. Beneath white; crown spotted with black; wings and tail brown; beneath paler. This species inhabits Panay, and is the size of the last. The bill and legs black.

CINEREA; Cinereous Tern. This species is cinereous; the head and chin are black; the lower tail-coverts and upper edge of the wings white. It inhabits Italy, and is thirteen inches long. The bill is black; legs red; chin sometimes spotted with white.

ALBA; White Tern. Entirely white; the bill and legs white. It inhabits the Cape of Good Hope.

OSTcura; Brown Tern. Above brown, beneath white; head black; wings variegated with brown and cinereous. This is probably the young bird of a former species.

NIGRA; Black-headed Tern. Body hoary; head and bill black; legs red. It inhabits Europe; and is a very small bird.

AUSTRALIS; Southern Tern. Cinereous; beneath grey; front yellowish-white; the quill-feathers are white. It inhabits the Nativity islands; and is from seven to nine inches long. The bill is black; the legs blackish; and the connecting membrane tawny.

SINENSIS; Chinese Tern. White; back, wings, and tail, cinereous; crown with a black band reaching as far as the nape. It inhabits China; and is about eight inches long. The bill is black; the legs tawny.

METOPOLIUS; Hooded Tern. Head and neck black; back blackish, hoary; wings cinereous; front, body black; neck, and tail, white. It inhabits Russia and Siberia; and is about nine inches long. The bill is yellow, and red at the base; the legs are of a fine fawn colour.

MINUTA; Lesser Tern. Body white; back hoary; front and eye-brows white. It is found in divers parts of Europe and America; and is the size of the last.

STRIATA; Striated Tern. White; hind-head and nape black; body above and wings with transverse black streaks. It inhabits Zealand. The bill is black; the legs are of a lead colour.
S T E N A T I A; Wreathed Tern. Cinereum; crown black; surrounded with white; the rump, vent, and tail, are white; the bill is red; and legs tawny. A variety has a cinerea

tail, with white shafts. It is found in Nativity island.

SPADICEA; Brown Tern. Reddish-brown; vent white; bill and claws black; tail and quill-feathers dusky; the secondaries tipt with white. It inhabits Cayenne, and is

fifteen inches long.

FUSCATA; Dusky Tern. Body blackish, without spots; bill brown, and legs red. It is found in the island of Hif-

paniola.

* FISIPES. Black; back cinerea; belly white; legs reddish. It inhabits in different parts of Europe and America; and is about ten inches long.

STERNATIA, in Geography, a town of Naples, in

the province of Otranto; 10 miles E.N.E. of Nardo.

STERNBERG, a town of Bohemia, in the circle of

Kauzim; 10 miles S. of Kauzim.—Alfo, a county of Weltphal, which takes its name from an old citadel; 10 miles E.N.E. of Lempurg.—Alfo, a town of Moravia, in

the circle of Olmutz; 9 miles N.N.E. of Olmutz. N. lat.

49° 40'. E. long. 17° 13'.—Alfo, a town of the duchy of Wurzburg; 6 miles E. of Lauringen.—Alfo, a town of Brandenburg, in the New Mark; 24 miles S.E. of Cufria. N. lat. 52° 23'. E. long. 15° 17'.—Alfo, a town of the duchy of Mecklenburg, situated on a lake; 16 miles S.E. of Wismar.

STERNE, Laurence, in Biography, the son of Roger

Sterne, a lieutenant in the army, and grand-nephew of Sterne, archbishop of York, was born at Clonmell, in Ireland, in November 1713, put to school at Halifax in 1722, and entered at Jesus college, Cambridge, in 1732, with a view to the church. After he had taken orders, he was presented to the living of Sutton, in Yorkshire, through the intereat of his uncle, Dr. Sterne, prebendary of York. In 1741

he was married, and by the fame uncle's intereat obtained a prebend in York cathedral. By means of his wife he became poiseed of the living of Stillington, where, and also at Sutton, the place of his residence, he performed duty for nearly twenty years. During this time, as he informs us, he amused himself with books, painting, fiddling, and floating. About this time, the only production of his pen was a little piece entitled "The History of a Watch-Coat," printed, but not published, about 1738, describing with humour some squabbles among the dignitaries of York, after the manner of Swift. In 1759 appeared two volumes of his "Life and Opinions of Tristram Shandy," a kind of peculiar novel, which was much read, and generally admired. Some commended and some cenured it. However, it secured profit to himself, as it was bought by the book-sellers, and as it was the means of procuring for him the presentation of the curacy of Coxwell. Several volumes appeared in succcession, and the last, or 9th, in 1766. This is an eccen-

cratic performance, formed upon the idea of a kind of self-taught philosopher, in the person of an elderly country gentleman, full of odd and singular notions, which he displays chiefly in the plan he forms for the education of an only son, commencing from, or rather before, his birth. The work is original in its composition and style; and abounds with a variety of characters, observations, and exquisite touches of the pathetic, intermixed with a sufficient quantity of the delicate and indecorous. It was new in its plan and execution, and though it has been often imitated, nothing entirely resembling it has yet appeared. To lay more about it is altogether needless; and to vindicate the confidence of the character of a clergyman with such a work would be an absurd attempt. In 1768 our author published another work, entitled "Sentimental Journey," in 2 vols. 12mo., which exceeded the former publication in popularity. With regard to purity and decorum, it is chargeable with the same, though perhaps not with equal, blemishes with the former. In 1760, availing himself of his fame, he published two volumes of "Sermons of Mr. Yorick," and two more in 1766. Sterne had long contended with a tendency to pulmonary consumption, which at length be-

came a confirmed disease, and terminated his life in March

1768. He left a widow and a daughter. The latter married a French gentleman, and published, in 1775, a collection of her father's letters, in 3 vols. 12mo., to which were prefixed "Memoirs of his Life and Family." In the same year an anonymous editor published "Letters from Yorick and Eliza," which were regarded as an authentic correspondence of Sterne with Mrs. Draper, an East Indian lady. We regret that at the close of this sketch of Sterne's life and writings, we are under a necessity of adding, that his private and domestic character did not comport either with the clerical profession, or with those traits and effusions of virtuous sensibility and benevolence which occur so frequently, and delight us so much in the perusal of his works.

STERNEN, in Geography, a town of Switzerland, in

the canton of Schwitz, the residence of Werner Stauff-

fach, one of the Swiss patriots, whose wife was also cele-

brated for her courage; 4 miles N.W. of Schwitz.

STERNO-CLEIDO-MASTOIDEUS, (sterno-masto-

doides and cleido-mastoideus of Albinus; sterno-clai-

roideus, mastoideus), in Anatomy, a muscle of the head, situated obliquely on the lateral and anterior part of the neck, where it makes a very conspicuous prominence in the living sub-

ject, and extending from the upper edge of the sternum, and the neighbouring part of the clavicle, to the mastoid process, and the ridge of the occipital bone. It is elongated, flattened on the surfaces, about two inches broad, and divided into two portions below. It is covered externally by the latissimus dorsi, the external jugular vein, and several branches of the cervical nerves, being interposed. At the upper part it is covered, for a small extent, by the parotid and the skin. Its internal surface lies on the sterno-clavicular joint, the sterno-hyoides and thyroideus, and omohyoides muscles, the internal jugular vein, and common carotid artery, the anterior branches of the cervical nerves, the nervus accessorius, the levator scapulae, the splenius capitis and digastricus. The anterior edge extends from the middle of the upper bone of the sternum, where it lies very near the opposite, and elevates the skin very sensibly, particularly in thin persons, along the side of the neck, separating more and more widely from the opposite muscle as it ascends, to the front of the mastoid process, where it is thick and prominent, and partly covered by the parotid gland. The posterior edge is thin, and a little concave, reaching from the clavicle to the upper ridge of the occiput. The lower extremity of the muscle is divided into two portions; an anterior or internal, called the sternum; a posterior or ex-
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ternal, called clavicular. The former, narrow and thick, is attached to the anterior and upper part of the sternum; the latter, much broader and thinner, is fixed to the pos-

terior edge of the upper surface of the clavicle, close to its connection with the sternum. The sternum portion ascends much more obliquely than the clavicular; hence the two

foot meet and decussate, the latter being considerably co-

vered by the former. A little dissection will generally sepa-

rate them half way along the neck, or more; and they are

always
always so far different, that Albinius describes them as two muscles. They are confounded together above, and attached to the apex and outer surface of the mastoid process, to the mastoid portion of the temporal bone, and to the superior curved line of the occiput. The temporal portion commences by a strong tendon, rising in front of the muscular fibres; the clavicular part originates by short aponeuroses. The upper extremity terminates by a broad strong aponeurosis, common to both parts; thinner in front than behind. All the muscular fibres go obliquely between the aponeuroses.

The sternox-clidomastoideus, by drawing the mastoid process forwards, rotates the head and the atlas on the axis, so as to turn the face to the opposite shoulder; in which effect it concurs with the opposite splenius, and obliquus inferior capitis. It will then incline the head and neck on the sternum. When the two act together, the head is not rotated, but bent, with the neck, directly forwards on the sternum. This operation of the sternox-clidomastoidei is more particularly observed in the recumbent attitude of the body; the head and neck are then raised in direct opposition to their gravity, and the recti and obliqui abdominis contract to fix the sternum and ribs, and thus to render the contraction of the sternox-clidomastoidei more effectual. In the erect attitude, the weight of the head naturally inclines it forwards.

STERNO-CLIDOMASTOIDUS, in Surgery. For an account of the division of this muscle in cases of wryneck, see TORTICOLLIS and WRYNECK.

STERNO-COSTALIS, in Anatomy, a muscle passing between the sternum and ribs. See INTERCOSTAE MUSCLES.

STERNO-HYOIDES, a muscle of the larynx. See HYOIDIA.

STERNO-MASTOIDEUS, in Anatomy. See STERNO-CLIDOMASTOIDEUS.

STERNOPTYX, in Ichthyology, a genus of fishes of the order Teleostomi, in which the generic character is as follows: Head obtuse, teeth very minute; no gill-membrane; the body is compressed, without apparent scales; breast cartilage, folded; belly pellucid. A single species only is mentioned by Gmelin, viz.

DIAPHANA. This is found in the American seas; it is small, compressed, truncate before, narrowed and silvery behind. The eyes are large, and of an amber colour: the mouth is perpendicular; the tongue thick and rough; the upper lip is short, lower perpendicular, with four semi-circular depressed cavities from the ridge, and three others under the aperture of the gills; the aperture is oblique, with soft covers; the folds of the branch form a pellucid ridge; the back is of a greenish-brown colour, gossipy behind the fin, with a double ridge diverging towards the softs; it has no lateral line; the dorsal fin with an obsolete, strong, spiny, immoveable ray, joined to which is a membrane very finely toothed at the edge: pectoral fins of a fine amber colour; tail bidual.

STERNESTEIN, in Geography, a town of Bavaria, with a ruined citadel, which gives name to a county. The country lies divided in the Upper Palatinate, and the town is situated 17 miles N. of Namburg.

STERNUM, in Anatomy, the breast-bone. It is the flat piece occupying the middle and front of the chest, and receiving the cartilages of the ribs in a series of small cavities on each side. See the description of the chest under the article LUNG.

STERNUM, Fractions of, in Surgery. See Fracture.

STERNUM OF BIRDS. See Anatomy of Birds.

STERNUTATIVE, or STERNATORY, such substances as polishes the quality of exciting freezing. It is not by the freezing which they excite, however, that these substances are useful medicinally; but by producing a discharge of fluids from the veins of the membranes lining the nostrils, by which some kinds of swellings of the head are relieved. In this quality they are more commonly denominated errhines, which see. See also SNEERING.

STERTOR. See SNEERING.

STERZINGEN, in Geography, a town of the county of Tyrol, celebrated for its manufacture of sword-blades: near it are silver-mines; 10 miles N.W. of Brixen.

STESICHORUS, in Biography, a Greek lyric poet, was born at Himera, in Sicily, and flourished about the year B.C. 612, being a perfour of some conformance in his name, and he is said to have died in the year B.C. 556. His works were numerous, and much esteemed by the ancients. They were composed in the Doric dialect, but they have all perished, except a few fragments, amounting to 50 or 60 lines, printed in the collection of Fulvius Ursinus, Ant. 1568. The general character of his writing is represented as confiting in force and dignity. Horace speaks of "Stesichori graves camonens"; and Dionysius says that he possessed all the excellencies and graces of Pindar and Simonides, and that he surpassed them both in the grandeur of his subjeets, in which he has well preserved the characteristics of manners and persons; and Quatras represents him as having displayed the sublimity of his genius by the felection of weighty topics, such as important wars, and the actions of great commanders, in which he has sustained with his lyre the dignity of epic poetry. Accordingly, Alexander the Great ranks him among those who were the proper study of princes. To him we owe the first introduction into the ode of the triple division of strophe, antistrophe, and epode, which were called in a Greek proverb "the three things of Stesichorus," from which he is said to have derived his name, as signifying the chorus, which was before "Tifias." Suida. Moreri.

STETTEN, in Geography, a town of Germany, in the margraviate of Anspach; 8 miles N.N.W. of Anspach.

STETTEN, New, a town of Hinder Pomerania, situated in the midst of lakes, built in the 14th century by duke Ratislaus IV., as a defence of the frontier against Prussia; but it has never flourished; 46 miles S.E. of Colberg. N. lat. 55° 42'. E. long. 10° 38'.

STETTIN, or Old Stettin, a town of Anterior Pomerania, and capital of that part which belongs to Prussia, situated on the Oder, which it divides into four branches. The town is large, handsome, and well fortified; and contains several manufactures, together with a dock for the building of ships. Its trade with England, Holland, France, Spain, Denmark, Sweden, Norway, Prussia, Danzig, Mecklenburg, Lubeck, and Hamburg, is very considerable. It contains five parish-churches, a college of physicians, a board of health, a chamber of commerce, a court of admiralty, &c. and about 20,000 inhabitants. It is rendered to the French in 1806; 12 miles W.N.W. of Stargard. N. lat. 54° 25'. E. long. 14° 44'.

STEWART, Sir James, in Biography, the only son of Sir James Stewart, bart., solicitor-general of Scotland to queen Anne and George I., and grandson of Sir James Stewart, lord-advocate of Scotland in the year 1692; was born
born in 1712, and after a regular course of education at Edinburgh, devoted himself to the study of the law. In conformity to the fashion of the times he undertook a foreign tour, and having spent five years abroad, returned to his native country, an accomplished gentleman, in 1740. About three years after his return he married lady Frances, the daughter of the earl of Wemyss, and retired to his seat at Coltness. Having formed an acquaintance with the Pretender at Rome, he renewed his connection with him at Aix-la-Chapelle in the year 1751, but the hopes of the exiled prince being frustrated, Sir James removed to France, and remained at Sedan until the year 1754. In the following year he removed to Flanders, and began to communicate to the public the fruits of his literary labours. In 1757, during his residence at Frankfort-under-the-Main, he published "A Vindication of Newton's Chronology"; and having settled in the same year at Tubingen, in Germany, he there published his "Treatise on German Coins," in the German language. This was followed, in 1761, by "A Dissertation on the Philosophy and Principles of Money," as applied to the German Coin; and in the same year he so far made his peace with the British government, as to obtain for his son a cornetcy in the English service. From Tubingen he removed to Antwerp; but on an excursion to the Spa, he fell under suspicion, and being arrested by the French, was sent prisoner to the fortresses of Charlemon. A remonstrance having been presented to the British cabinet, and peace being reestablished, Sir James regained his liberty. Under assurances of protection in his native country, he settled at Coltness in 1763; and in this retirement he probably snuffed his work entitled "Inquiry into the Principles of Political Economy," on which he had bestowed the labour of eighteen years. In 1769 he again presented to the public, under the name of Robert Frame, "Considerations on the Interests of the County of Lanark." His full pardon passed the great seal in 1771; and in the following year he printed the "Principles of Money applied to the present State of the Coin of Bengal." He also wrote "A Plan for introducing an Uniformity of Weights and Measures," published after his death; and engaging in metaphysical speculations, he published "Observations on a Short Essay on Truth," and "Critical Remarks on the Atheistical Fallacies of Mirabeau's System of Nature," 1779; and soon after, "A Dissertation concerning the Motive of Obedience to the Law of God." He died in November 1780, at the age of 67, leaving one son, Sir James Stuart Denham, bart. a general in the army, and colonel of the 12th dragoons. His collected works were printed at London in 1805, in six vols. 8vo.

STEUBEN, in Geography, a county of New York, erected from the S. part of Ontario in 1796, and so named in honour of baron Steuben, an officer in the revolutionary armies. Its form is regular, being about 40 miles square; and it is bounded N. by Ontario county, E. by the southern part of Seneca county, or by Seneca lake, and by Tioga county, S. by the state of Pennsylvania, and W. by Allegany county. Its area is 1641 square miles, or 1,650,240 acres; and it is situated between 42° and 43° 30' N. lat., and 7° 30' and 8° 30' W. long. from New York. Its towns are Addison, containing 369; Bath, with 1356; Canisteo, with 656; Danville, with 666; Painted-Peak, with 954; Pultney, with 1028; Reading, with 1310; Troupsburg, with 200; and Wayne, with 1025 inhabitants; amounting in the whole to 7246. This county is 203 miles N.W. from New York. Its surface is hilly, if not mountainous. Near the rivers its aspect is not inviting, except that the alluvial flats are in some parts very extensive and rich. The upland plains have a rich variety of deciduous trees, and extensive tracts of a rich and fertile soil, principally argillaceous or a warm mould. This county, the small town of Reading excepted, was included in the cession of New York to Massachusetts, and is principally peopled by farmers from the eastern states. The agriculture is improving; and the eastern people have brought hither their habits of houehold industry, from which the clothing is chiefly produced. The capital is Bath. This county has 445 electors, and sends one member to the house of representatives.

STEUBEN, formerly Naragaguus, a town of the district of Maine, in the county of Washington, at the S.W. corner of the county. Naragaguus river runs through its N.E. corner. It contains 552 inhabitants.--Alfo, a small fort in the Indiana territory, situated at the rapids of the Ohio, a little above Clarksville.--Alfo, a township of New York, in Oneida county, taken from Whitelawn, and incorporated in 1792. In 1796, the towns of Floyd and Rome were taken from this township. The western branch of Mohawk river rises here, and the centre of the town is about 13 miles N.E. of Fort Schuyler, and 32 N.W. of the mouth of Canada creek.

STEUBENVILLE, a post-town of Jefferson county, in the state of Ohio, situated on the W. bank of the Ohio, a few miles W. of the Pennsylvanian W. line, and containing 1617 inhabitants; 312 miles from Washington. N. lat. 40° 17'; W. long. 5° 30' from Philadelphia.

STEVE, a town of Sweden, in East Bothnia; 35 miles E.N.E. of Gamla Carleby.

STEVENS' Klint, a mountain of Denmark, in the island of Zealand, near Heddingen.

STEVENAGE, a village in the hundred of Broadwater, and county of Hertford, England, was anciently a market-town, and named Stigenaise, or Stingenhage. The manor was given by Edward the Confessor to Wulfminster Abbey, and was thereto annexed, till Henry VIII. converted the abbey to a bishop's see. After its dissolution by Edward VI., Stevenage, with Ashwell, and other manors in this county, became by grant the property of the see of London, to which they have ever since belonged, with the exception of a short period of possession by a convocation of queen Mary. It received, through the influence of Montaine, bishop of London in the time of James I., the grant of a weekly market, and three annual fairs. In the fifth year of William and Mary, a charter of confirmation was granted, with liberty to alter the market-day to Friday; but the contiguity of the towns of Baldock and Hitchin has greatly tended to the decay of this. Stevenage consists of one large, and several lesser streets, with a free school, and a small church, containing a nave, chancel, and aisles; a chapel on each side the chancel, with a tower at the west end. The population of this place, as returned in 1811, amounted to 1302, and the number of houses to 308. The petty feoffons for Stevenage division are held here. About three quarters of a mile southward from this place, on the east side of the high road, are six large barns, some of which have been superficially opened, but nothing of consequence has been discovered: they appear to be composed of gravel and fine clay; and have been thought, from the titles of Dane-end, Mundane, &c., which occur in this part of the country, to be of Danish origin. Stevenage is pleasantly situated on the high North road, 124 miles N.W. by N. from Hertford, and 514 miles N.N.W. from London. Beauties of England and Wales, vol. vii. by J. Britton and E.W. Brayley.

STEVEN'S, a short navigable river of America, which runs
rises in the district of Maine, within a mile of Merry Meeting bay, with which it is connected by a canal lately opened.

STEVENSBURG, a port-town of Virginia, in Culpepper county, on the road from Philadelphia to Staunton. It contains from 40 to 50 houses, and an academy. The inhabitants are mostly of Dutch extraction; 10 miles N. by E. from Strasburg, and 90 from Washington.

STEVENIA, in Botany, is said to have been so named by M. Poiteau, a French botanist, in compliment to Dr. Edward Stevens, American consul at Hispaniola, or St. Domingo, who had rendered many important services to the French in that island; but whether he composed any skill in botany does not appear; neither is he recorded to have afforded any particular patronage to this science. — "Poiteau Ann. du Mus. d'Hist. Nat. v. 4. 235." Poiret in LamarckDict. v. 7. 439. —Claro and order, Hempodina Monotypia. Nat. Ord. Rubiaceae, Juill. 

Gen. Ch. Cal. Perianth superior, of one leaf, in two deep, lanceolate, deciduous segments. Cor. of one petal, tubular, slightly silvery externally; tube cylindrical, the length of the calyx limb in six, sometimes seven, oblong, obtuse, spreading, somewhat reflexed segments. Stam. Filaments none; anthers inserted into the upper part of the tube of the corolla, and equal in number to the segments of its limb, oblong, straight, two-lobed, of two in each. Fil. Germ. globose, inferior; style erect, the length of the tube; stigmas two, spreading. Peric. Capsule globose, coated, of two cells and two valves, separating at the top, the partitions from the flexed margins of the valves, which at length split longitudinally into two parts. Seeds numerous, minute, oval, a little compressed; enucleated at the upper part with a membranous wing; tapering and pointed at the base. Receptacle central, hemispherical, forming the division between the two cells.

Eff. Ch. Calyx inferior, in two deciduous segments. Corolla tubular, with six or seven segments. Anther sessile in the mouth of the tube. Capsule of two cells, with many winged seeds.

1. S. bunifolia. Box-leaved Stevia. Poiteau Ann. du Mus. d'Hist. Nat. v. 4. 235. t. 60. —Native of the northern part of Hispaniola. An upright branching shrub, ten or twelve feet high; the wood very hard; bark ash-coloured, full of cracks. Young shoots covered with a viscid resin. Leaves opposite, flat, oblong, acute at each end, about an inch and half in length, rigid, smooth, shining above, pale and reticulated beneath. Footstalk short, connected by an undivided sheathing stipula. Flowers axillary, solitary, white, fragrant, on footstalks the length of the footstalks. Bracteae at the base of the calyx, in four divisions, two of which are short and obtuse, two the intermediate ones lanceolate and twice as large, sometimes leafy. We know this plant only from the descriptions of the authors above cited.

STEVENSWAERT, or Fort of St. Etienne, in Geography, a fortress of France, in the department of the Roer, situated on the E. side of the Meuse, built in the year 1653, besieged and taken by the allies in 1702; 50 miles N. of Liege.

STEVENTOWN, a township of New York, in Weftchester county, bounded W. by York town, and N. by Dutchess county, containing 1773 inhabitants.

STEWER, a river of the principality of Munster, which runs into the Luppe at Hattern.

STEVIA, in Botany, was named by Cavanilles in memory of Peter James Steive, or Elève, an eminent physician of Valencia, and professor of botany in that university, towards the middle of the 16th century. He is said to have published some valuable works, and to have left in manuscript a dictionary of the plants of the country where he resided. —Cavan. l.c. v. 4. 32. Wild. Sp. Pl. v. 3. 1774. Ait. Hort. Kew. v. 4. 510. —Claro and order, Hempodina Monotypia. Nat. Ord. Composita diffusa, Linn. Corymbifera, Juff.

Gen. Ch. Common Calyx simple, oblong, of several, nearly equal, leaves, in a simple row. Cor. compound, uniform, dicoid. Florets all uniform, perfect, fertile, funnel-shaped, with a five cleft spreading limb, not numerous. Stam. Filaments in each floret five, capillary; anthers united into a cylindrical tube. Fil. Germ. oblong; style thread-shaped; stigmas two, long and slender. Peric. none, except the permanent upright calyx. Seeds solitary to each floret, oblong; down chaffy, or partly bristly. Recept. small, naked.

Eff. Ch. Receptacle naked. Down chaffy. Calyx cylindrical, of a simple row of leaves. Obf. This genus is distinguished from Eupatorium and Ageratum, by its simple row of calyx-leaves. From the former, moreover, the chaffy feed-down keeps it clearly distinct.

1. S. linearis. Linear Stevia. Willd. n. 1. Cavan. l.c. v. 4. 32. (Ageratum lineare; ibid. v. 3. 3. t. 205.) Stem herbaceous. Leaves simple, linear to linear-lanceolate. Footstalks of five lanceolate scales, from the top. Native of New Spain, flowering in the garden at Madrid, from August to November, in the open ground. The stem is two feet high, branched, glaucous and smooth, like the rest of the plant. Leaves scattered, on short footstalks, entire, obtuse, narrow, an inch and half long, the lower ones often opposite. Flowers pale rose-coloured, terminal, corymbosse, not numerous. Bracteae solitary, at the base of each partial footstalk, linear-lanceolate. Calyx three-quarters of an inch long. Scales of the feed-down spreading, linear-lanceolate, acute, whitish, about the length of the downy feed.

2. S. Eupatoria. Three-ribbed Stevia. Willd. n. 2. Ait. n. 1. (Muffelia Eupatoria; Sprengel in Tr. Linneus. Soc. v. 6, 152. t. 13.) —Stem herbaceous. Leaves lanceolate, nearly entire, three-ribbed. Flowers crowded. Seed-down of short scales, with intermediate bristles. Native of Mexico. Brought from the Madrid garden, by the late marchioness of Bute, in 1798. A hardy perennial herb, flowering from July to September, but of no striking appearance. The stem is two feet high, inclined or spreading, round, leafy, its branches terminating in numerous small corymbosse flowers, of a reddish hue. Leaves rather above an inch long, shining, dotted, occasionally ferrated towards the point. Willdenow describes three obtuse scales, with as many intermediate bristles, in the crown of each seed; which answers to Sprengel's figure, but the latter describes five bristles.

3. S. follicifolia. Willow-leaved Stevia. Cavan. l.c. v. 4. 32. t. 554. Willd. n. 3. Ait. n. 2. —Leaves lanceolate, serrated, tapering and entire at each end. Seed-down of two awl-shaped bristles. Native of Mexico. Its seeds were sent to the writer of this, from the Madrid garden, in 1803. This is a greenhouse herbaceous plant, flowering in August and September, about two feet high. Leaves two or three inches long, smooth; glaucous beneath. Flowers corymbosse, more copious, but much smaller than in the first species; the florets flesh-coloured, with a red tube. Seeds slender, each crowned with two very narrow, rather spreading, bristles.

Jacq. Hort. Schoenbr. v. 3. 28. t. 300.)—Leaves linear-lanceolate, most ferrated towards the point. Seed-down of three short scales, with intermediate bristles.—Native of Mexico. We received it from the rich garden of the late Rev. Mr. Watts, of Aihill, Norfolk. It is a hardy perennial, flowering in autumn, about the size of the last, but its leaves are smaller and more abundant; flowers larger and white, in level-topped, corymbose panicles. The three long rough bristles which crown the seed are membranous at the edges, and connected by a membranous crown at the base, agreeing in structure, and, we doubt not, in number, with the same part in our second species.

5. S. pedata. Compound-leafed Stevia. Cavan. Ic. v. 4. 33. t. 356. Willd. n. 5. Ait. n. 4.—Leaves pedate, entire. Seed-down of several short equal scales.—Native of Mexico. Its seeds were received from Madrid, with those of the third species, in 1803. This proves a hardy annual in our gardens, flowering from July to September. The stem is two or three feet high, a little downy, fristated. Leaves seven, stalked, entire, elliptic-lanceolate, roughish; the middle one an inch and half long; the lateral ones gradually smaller. Flowers white, small, but of more numerous florets than of the same species, with violet anthers. Seed crowned with about ten, equal, short, obtuse scales.

STEVIN, SIMON, in Biography, was born at Bruges after the middle of the 16th century, but the year of his birth is not ascertained. He was held in great estimation by Maurice, prince of Orange, whose own taste led him to respect the mathematical and mechanical acquirements of Stevin, and he was employed in Holland as an inspector of the dykes. He seems to have been the first person who discovered the true proportion between the power and the weight on an inclined plane, which he accurately determined in all the different cases. In hydrostatics he was also no less an adept than in mechanics; and to him we owe the discovery of the famous paradox, that a fluid contained in a tube decreases its pressure, as with the same pressure on the base as if the tube were everywhere uniform. He was also the inventor of a sailing boat, which was moved entirely by the impulse of the wind, and with such velocity, that it conveyed passengers from Scheveling to Putten, through a distance of about forty miles, in the space of two hours. Although the exact form of this vessel is not much known, it excited general attention. Grotius, who was a passenger in it, wrote a poem in reference to it, intitled "Iter Currus Veliferi," and he has made it the subject of more than twenty epigrams, in one of which are the following lines:

"Ventivolium Tiphys deduxit in aqua naves;
Jupiter in felibus uterque anegdomus.
In terrisque folum virtus Stevina: nam nec
Tiphys tuum fuerat, nec Jovis ilud opus."

It is also ascertained by Swertius and Valerius Andreas, that Stevin could raise any weight with a small power, by a simple machine, called by the latter "pancraetor." Stevin died at Leyden, according to Weidler, in 1633. His works are: "A Book of Arithmetic in French," printed by Plantin at Antwerp in 1588; 2 vols., and reprinted with the whole Algebra in Flemish, in 1605: "Problematum Geometricorum, Lib. V." 4to; and various other treatises in Flemish, translated into Latin by Snellius, under the title of "Hypomnemata Mathematica," Lugd. Bat. 1608, 4 tom. fol. of which there is a French edition, with curious notes and additions by Albert Girard, 1634. 6 vols. fol. The first contains arithmetic and algebra, with tables of interest; the second, cosmography, that is, the doctrine of triangles, geography, and astronomy; the third, practical geometry; the fourth, statics; the fifth, optics; and the sixth, cafframetica, fortification by fluxes, and general fortification. One of his treatises relates to the finding of harbours, and is intitled in the French edition "Du Trouve-Port, ou la Maniere de trouver les Havres," which was translated by Grotius into Latin verse, 1599, 4to. Montucula says, that none of Stevin's works contain any new things, except his Mechanica; but Dr. Hutton informs us, that his improvements in algebra were many and ingenious. Hutton's Diäc. and Mathematical Tracts. Montucula. Weidler Hist. Ant. Wilkins's Math. and Phil. Works. Gen. Biog.

STEW, a small kind of fish-pond, the peculiar office of which is to maintain fish, and keep them in readiness for the daily uies of the family, &c.

The fish bred in the large ponds are drawn out, and put in here. For two large ponds of three or four acres a-piece, it is advisable to have four flews, each two rods wide, and three long. The flews are usually in gardens, or at least near the house, to be more handy, and the better looked to. See Fish-Pond.

In the construction of flews or ponds, the sides of them should be cut down sloping, carrying the bottom in a continual decline from end to end, so as to have a convenient mouth, as horse-ponds have, for taking out nets in drawing for fish: and if there be room enough, a mouth may be made at both ends, and the deeps part be in the middle, by which means the net may be drawn backwards and forwards, and the fish not have such shelter as is given by a depth under a head. And besides, the fish delight to come upon the shoals, and probably thrive better. These may chiefly be referred for carp, but not absolutely; and where tench and perch increase and prosper, smaller flews may be made to serve them apart, and take them when wanted, without disturbing the other fish. See Fish.

In general, the strongest and best fish, where it can be done, are faved and preferred for being put into the flews, in order to be brought forward, and got ready more quickly for the table.

In places near the sea, there are frequently salt-water flews formed for keeping various kinds of sea-fish. It is noticed in the account of the state of the agriculture of the county of Essex, that the flews for sea-fish in Foulness island, in that district, are extremely well contrived, and answer the purpose in a complete manner. The fish for them are, it is said, caught in weirs, on the extensive sands, which run out several miles on the coast there, and then, when plentiful, deposited in these flews, where they are afterwards dragged for, as wanted, with a small net, as in flews of the fresh-water kind. See Fish-Ponds, and Pond Fisheries.

It is material in all sorts of flews, that there be something of the house kind near to or connected with them, for the safety and securing of the fish, as well as for the purpose of ornament in some cases. Different flews may in this way be made to be partially covered and divided by them: and by having perforations opened through the dividing parts, the waters of the different ones may flow through and communicate with the whole. They may also have trap-doors, openings for each of the different flews, made to be so closed and fastened, as that no perfon, except the owner, can have the means of opening them, and getting at the fish, without being liable to detection.

These sorts of contrivances may be beneficially had recourse to in most cases, as preventing all risk of depredations being committed; and in some cases, where the flews are connected with the residencies of men of fortune, they may have such forms and shapes given them, as may render their
their effects highly ornamental; besides serving as habitations for old domestics.

Different sorts of fish, besides being preferred, are often raised and fed to very great sizes in tanks. Stews, or Stews, were also places anciently permitted in England, to women of professed incontinency, for the proffer of their beds to all comers. These were under particular rules and laws of discipline, appointed by the lord of the manor. See Southwark.

The word is probably borrowed from the French, effet, hot-baths, in regard profitantes are wont to prepare themselves for venereal acts by bathing.

STEWARD, or SERNESCHAL, an officer, of whom there are various kinds; thus called from the Saxen fles, fleas, place, or room; and ward, keeper, q. d. a deputy, or person appointed in the place of another. See Serneschal.

Steward of Great Britain, Lord High, is the first and highest officer of the crown; as having the power of what we call a vice-roy, the Danes, &c. feudalholder, and the Swedes, reichs drofett, q. d. vice rex. Chamberlayne.

Common lawyers call him magnus Angliae finem bellum.

His office, as expounded in an ancient record, is to supervise and regulate the whole kingdom, both in time of peace and war, immediately under the king, and after him, as authority in every part, that he has not been judged idle to trust it any longer in the hands of any subject.

The office was hereditary and permanent in the family of the dukes of Lancaster, till the time of Henry IV. since whom it has only been made pro hac vice, occasionally: as to officiate at a coronation; at the arraigning and trial of some noblemen for treason, or other great crime. And it hath been the constant practice (and therefore seems now to have become necessary) to grant it to a lord of parliament, else he is incapable of trying such delinquent persons.

During his stewardship he bears a white staff in his hand, and the trial, &c. ended, he breaks his staff, and with it his commission expires.

Steward, Court of the Lord High. See Court.

Steward of the House, Lord, is an officer, to whom the state of the king's house is committed, to be ruled and guided at his discretion. See Household and Lord Steward.

Steward, Court of Lord. See Court. See also Marquisate Court.

Steward of the Universities, Lord High. See University.

Steward of a Ship of War, an officer appointed by the purser to distribute the different kinds of provision to the officers and crew, for which purpose he is furnished with a mate and proper assistants.

He hath an apartment for himself in the hold, which is called the steward's-room, built on the larboard side of the after-platform, nearly aft.

STEWART, MATTHEW, D.D. In Biography, professor of mathematics in the university of Edinburgh, was the son of the Rev. Dugald Stewart, minister of Ruthfay, in the isle of Bute, where he was born in the year 1717. As soon as he left school in 1734, being intended for the church, he was entered at the university of Glasgow, where his application and proficiency engaged the peculiar notice and friendship of the two eminent professors, Dr. Hutcheson and Dr. Simfon. The latter especially, perceiving probably in young Stewart talents and propensities of study resembling his own, initiated him betimes in the sublime speculations of the ancient geometry, to which he afterwards manifested a very decided attachment. As his views required his attendance on the lectures at Edinburgh, in 1744, Dr. Simfon recommended his favourite pupil to the celebrated Maclaurin, whose lectures he attended, and by which he gained profit. At this time he kept up a regular correspondence with professor Simfon, communicating to him the progress of his studies, and his geometrical discoveries, which were even at this time various and important, and receiving in return interesting information with regard to the Locs Plani and Porismata of Euclid. Both the professor and the student prosecuted their investigations of these abstruse subjects in different directions, but with similar success. The result of Mr. Stewart's enquiries was the discovery of those curious propositions, which he published in 1746, under the title of "General Theorems," and which gave him high rank, at an early age, among eminent geometers. Whilst he was engaged in these speculations, he had entered into the church, and under the patronage of the earl of Bute and the duke of Argyle, he was presented with the living of Rosneath; and in this retired situation he had discovered the greater part of the fore-mentioned propositions. But the death of Maclaurin, in 1746, afforded an opportunity for his being advanced to the mathematical chair in the university of Edinburgh, for the very able and elegant work of that eminent mathematician and philosopher in September, 1747. His new professorship led to some change in the direction of his mathematical studies; and led him to make an application of geometry to those problems, for the solutions of which the algebraical calculus had been employed. The first specimen of his success in this way was the solutions of Kepler's problem, founded on a general property of curves, which, perhaps, had never been before observed. This was published in the second volume of the "Effays of the Philosophical Society of Edinburgh," for 1756. The first volume of the same magazine contains some curious speculations on the subject of porisms, and which are demonstrated with all the elegance and simplicity peculiar to the ancient analysts. Attached to the geometry of the ancients, Mr. Stewart had formed a plan of introducing its strict and simple mode of demonstration into the higher parts of the mixed mathematics; and in the prosecution of this plan he composed his "Tract Fisychial and Mathematical," which were published in 1761. Mr. Stewart, in the first of these tracts, lays down the doctrine of centripetal forces in a series of propositions demonstrated from the quadrature of curves being admitted, with the utmost rigour, and requiring no previous knowledge of mathematics, except the elements of plane geometry and of conic sections. Accordingly this tract may be regarded as the best elementary treatise of physical astronomy extant. In the three following tracts the author proposed, in the same method, to determine the effects of those forces which disturb the motions of a secondary planet; and from these it was his design to deduce, not only the theory of the moon, but the sun's distance from the earth. But his declining health did not allow him to pursue the arduous investigation of these subjects. In the year 1763, when the result of the observations of the transit of Venus had been unsatisfactory to astronomers, Dr. Stewart determined to apply the principles he had laid down to this subject; and accordingly in this year he published his "Effay on the Sun's Distancy," where, from actual computation, the parallax of the sun was found to be no more than 6.99, and consequently its distance nearly 29,875 semi-diameters of the earth, or about 1,155,414,428 English miles, a distance so much exceeding all former estimates as to excite surprise, and to produce a favorable examination of the principles on which the calculation was founded.
founded. This "Effay" was the last work which Dr. Stewart published; but he declined engaging in any controversy on the subject. Some months before he published his "Effay," he prented to the public another work adapted to promote the study of the ancient geometry, and entitled "Propositiones Geometricae, more Vetricum demonstratas." By his confluent use of the geometrical analysis he obtained many valuable propositions, several of which have found a place in the writings of Dr. Simson. Soon after the year 1765, the health of Dr. Stewart began to decline, and he was unable to encounter the fatigue of the duties of his office. He therefore retired to the country in the year 1772, and never resumed his labours in the university. In 1775 he had the satisfaction to see his son, Mr. Dugald Stewart, elected joint professor with him; and when mathematical studies ceased to be his business, they were still his amusement. Having at an early period of his life admired the analogy between the circle and hyperbola, his attention, during the leisure of his advanced life, was directed to this subject, and he left among his papers some curious approximations to the areas of both. At the length the state of his health would not allow him to prosecute this study even as an amusement; and he closed his honourable life in the month of January, 1785, at the age of 68 years. Dr. Stewart's application had been from his youth most intense and continued; his mental faculties preserved an extraordinary vigour; and his memory was so tenacious, that he retained his discoveries, and he rarely wrote out any of his investigations till it became necessary to do so for the purpose of publication. When he discovered a proposition, he put down the enunciation with great accuracy, and on the same piece of paper constructed very neatly the figure to which it referred; for every thing else he trusted to his memory. Although he was very judicious, he read few books. After the academical labours of the winter were concluded, he spent the summer at a delightful retreat in Airthire, where he found leisure to prosecute his favourite researches. "Transactions of the Royal Society of Edinburgh."

Stewart, in Geography, a county of the district of West Tennessee, in America, containing 4262 inhabitants, of whom 779 are slaves.

Stewart's Islands, a cluster of small islands in the South Pacific ocean, discovered by captain Hunter in the year 1791, and so named in honour of admiral Keith Stewart. S. lat. 8° 40'. E. long. 163° 18'.

Stewartia, or Stewart's town, in Geography, a town in the district of Cunningham, and county of Ayr, Scotland, is seated in a pleasant and fertile district, on the banks of the river Annach, at the distance of six miles N. from the town of Irvine. From a comparative view of the population reports of 1800 and 1811, it appears that Stewarton has greatly increased in houses and inhabitants during the intermediate eleven years, as at the former date, there were 447 houses, and 2657 inhabitants; and at the latter, the number of houses was 484, and that of inhabitants 1749.

The town and parish feoffed to have derived their name from the royal and unfortunate family of Stuart, who had a mansion here at a remote period, and part of it still remains. The principal trade of the town is the manufacture of bonnets, which has been continued for upwards of a century past to a great extent. A general post-office is here established. Here are a weekly market, and several well-attended fairs. The general appearance of the parish is flat, with a gentle descent towards the sea; and it is decorated with extensive plantations. The soil is chiefly strong clay; and lime-quiaries abound in great plenty; its extent is upwards of ten miles in length, and some places about four in breadth. — Carlile's Topographical Dictionary of Scotland, vol. ii. qto. 1813. Gazetteer of Scotland, 8vo. 1806. Sinclair's Statistical Account of Scotland, vol. ix.

Stewartstown, a post-town of the county of Tyrone, Ireland; 77 miles N. by W. from Dublin, and 5 miles N. from Dungannon.

Stewartstown, a town of America, in the county of Coos and state of New Hampshire, containing 186 inhabitants.

Stey Point, a cape on the coast of Labrador. N. lat. 56°. W. long. 61° 42'.

Steyenberg, a town of Germany, in the county of Hofa; 9 miles S.W. of Nienburg.

Steyll, a town of the duchy of Berg, lately belonging to the abbey of Essen; 2 miles S.E. of Essen. N. lat. 51° 22'. E. long. 9°.

Steyning, a borough-town in the hundred of Steyning, rape of Bramber, and county of Sussex, England, derives its name from the Steyne-stream, an ancient road, which passed through this part of the country. In the population return for 1800, it is stated to have contained 215 houses, and 1174 inhabitants; but in 1811, the houses only amounted to 187, and the inhabitants had increased to 1039. Here is a weekly market on Wednesday, a monthly one for cattle, and three annual fairs. It is seated at the foot of a lofty hill, near the river Adur, and is formed by four transverse streets.

Steyning is a borough by prescription, and returns two members to parliament, elected by the householders and inhabitants, who do not receive alms, within the borough, amounting to 80. The municipal government is vested in a confiable, who is on such occasions the returning officer; and is appointed at the court-leet of the lord of the manor. The town is connected with the town of Bramber, and is formed of Bramber, and is entitled to return two representatives, although one part of Bramber is in the centre of Steyning, and a part of Steyning intersects Bramber in a similar manner. See Bramber.

The church is an edifice of great antiquity, but of this building only the nave remains. It contains some very curious specimens of early Norman architecture. The tower is of flint and stone, with buttresses at the corners. About the middle of the 16th century, a free grammar-school was founded in this place, and endowed with lands to provide for the salary of the master. There have been also of late years extensive barracks erected here for infantry.

At a very remote period, a Benedictine priory for monks existed in this town, founded by Edward the Confessor; the church, which appertained to this establishment, and which is supposed to be that already noticed, contained the sacred relics of St. Cuthman, and of Ethelwulf, father of Alfred the Great. — Beauties of England and Wales, 8vo. 1814. By F. Shoberl, vol. iv. Carlile's Topographical Dictionary of England, vol. ii. Representative History of Great Britain, by T. H. B. Oldfield, vol. iii. 8vo. 1816.

Steyr, a town of Austria, situated on a small river near its conflux with the Enz, the inhabitants of which are mostly engaged in manufactures of iron and steel. It was formerly pre-eminent among the royal towns, but hardly a vestige of its reputation now remains. It was once the capital of a county belonging to Stiriia, but being separated...
Separated from Stiria, it was added to the country above the Enns, and hence deemed merely a feignory. It has often suffered much by fire; 80 miles W. of Vienna. N. lat. 48° 17'. E. long. 14° 23'.

STARYE, a town of Austria, on the N. side of the Danube; 84 miles W. of Vienna. N. lat. 48° 17'; E. long. 14° 25'.

STAYEB, a town of Austria; 5 miles E. of Glagnitz.

STAZZANO, a town of Italy, in the department of the Serio; 3 miles S. of Bergamo.

STAYANU, in Mythology, a name of the Hindoo god Siva, by which he is frequently designated in the celebrated poem the Purana. See Siva.

STHENIA, from sthénos, strength, a word of great import in the Brunnian theory of medicine, implying an inflammatory diathesis, and standing in opposition to asthenia, or debility, to one of which that ingenious but mistaken pathologist ascribed all disordered incidents to the living body. See Excitability.

STHENIA, σθενα, in Antiquity, a festival of Argos, supposed to be kept in honour of Minerva, furnished with sthenia, from σθένος, strength.

STHENIUS, in Mythology, denoting powerful or strong, one of the epithets of Jupiter; as Sthenius, or robust, was one of the epithets of Minerva.

STIL, a word used by some of the old authors for pebbles found on the sea-shore.

STIBAGION, among the Romans, a low kind of table-couch, or bed of a circular form, which succeeded to the triclinia, and was of different sizes, according to the number of guests they were designed for. They were held fixed, eight, or nine guests, and so of any other number.

STIBELAW, in Geography, a town of Pomerelia; 30 miles S.S.E. of Dantzig.

STIBILIA, a term used by some to express the antimonial medicines.

STIBING, in Geography, a town of the duchy of Stiria; 7 miles N.N.W. of Graz.

STIFINUS, a term used by St. Jerome, and others, to express the false black colour which the ancient Jews, and other eastern people, gave to their eyes-brows with stibium, or antimony.

STIBIUM, See Antimony.

STIBIUM Ceratun. See Vitrum Antimonii Ceratun.

STIBITITZ, in Geography, a town of Bohemia, in the circle of Koniggratz; 24 miles E. of Koniggratz.

STICA, a name given by some authors to all external astringents used in hemorrhages.

STICA, in our Old Writers, a copper or billon heptarchic coin, of the value of half a farthing, four of them making an eling. This small piece was only known in Northumbria, and in the later period of that kingdom. See Penny, and Serrata.

STICHOMANTIA, τίχομάντια, in Antiquity, a sort of divination by verbs (commonly those of the Sibylline oracles), which being wrote on little pieces of paper, and thrown into a silver vessel, the first drawn out was supposed to contain the will of the gods. See Sortes.

STICHEOMETRY, formed of τίχος, verse, and μέτρον, I measure, in Scripture History, a catalogue of books of sacred scripture, to which is added the number of the verses which each book contains.

STICHOS, a name given by the old writers to a pectoral confection, the principal ingredient of which was the herb marjoram, or horeshare.

Stick of Eels, a quantity or measure of twenty-five. A kind of eels contains ten flocks, and each flock twenty-five eels. Stat. Weights and Measures.

STICKS, a kind of straight sticks or poles, that is made of wood, to which is fastened by a cord or thong, a sharp point to be used in fencing, boxing, etc.

STICKADORE, in Botany. See Cassidony.

STICKELSTA, in Geography, a town of Norway, in the province of Drongheim; 46 miles E.N.E. of Drongheim.

STICKHAUSEN, a town and citadel of Eaft Friesland, founded by the Hamburghers about the year 1435, as a security against pirates, and afterwards still farther fortified; 18 miles E.S.E. of Emden. N. lat. 53° 14'. E. long. 7° 16'.

STICKLEBACK, in Ichthyology, a name given by us to that small fish called by authors by the several names of pimelis, pimam, and pungitius pimam; as also pimela villis, pimelis aculeatus, and the like; and finally, by Arcted, by the much more expressive name of gasteroboeus, expressing that great singularity it has in the bony structure of its belly.

The common stickleback, or gasteroboeus aculeatus of Linnaeus, is distinguished by Arcted by the name of the gasteroboeus with three spines on the back; and by this character it differs from the other species of this genus.

It is a very well-known fish, and is found everywhere in new-dug ditches, &c. where no body can perceive how it comes. Hence the vulgar have an opinion, that it breeds there equivocally and of itself, without the help of partners of its own kind, and that from it all other fishes are derived.

These are idle opinions: the smallest animalcule is not produced in putrid matter otherwise than by the egg of a parent animal; this origin will, therefore, hardly be believed of larger, and as they are called, more perfect animals. These small fish are so far from peopling ponds with other fish, that they are very great devourers of the spawn of larger fish, and do infinite mischief in ponds.

These are found no where in such great quantities as in the fens of Lincolnshire and Cambridgeshire, and some of the rivers flowing from them. At Spalding there are, once in seven or eight years, amazing shoals that appear in the Weald, and come up the river in the form of a vast column. These are supposed to be the multitudes that have been washed out of the fens by the floods of several years, and collected in some deep hole, till, overcharged with numbers, they are periodically obliged to attempt a change of place. The quantity is so great, that they are used to manure the land, and trials have been made to get oil from them. See Phil. Trans. No. 225. For the characters of this and the other species, see Gasteroboeus.

It is observed in the Norfolk Reports on Agriculture, that these little fish, which are caught in immense quantities in the Lynn rivers about once in seven years, have been bought as high as eight-pence a bushel. The favourite way of using them now, is by mixing them with mould, and carrying them on the land for turnips. Great quantities have been carried to Marham, Shouldham, and Beachwell. Mr. Fuller, there, is reported to have laid out 400l. for them in one year; they always answer exceedingly.

And Mr. Roger, of Narborough, has gone largely into this husbandry, laying out 300l. in one year, at 6d. to 8d. per bushel, besides carriage from Lynn: he formed them into composts with mould, mixed well by turning over, and carried them on for turnips: the success was very great. There can be no doubt but that these small fish afford a good animal manure.

Matters of this kind constantly afford a most efficacious manure, and should mostly be applied in the fresh state, though
though in limited proportions, according to the nature and condition of the land. When first mixed with good rich earthy substanaces, as above, they are probably in the best state of application for the promotion of arable crops. The operation of such filthy substanaces, as manure, is readily elucidated and explained. The fleshy parts of them, the writer of the work on "Agricultural Chemistry" considers as principally consisting of gelatine, which, from its slight state of cohesion, is quickly soluble in watery fluids; and, besides, the fatty matter which constitutes different internal parts of them, readily becomes useful in the same way. Their fibrous matter contains all the elementary matters of vegetable substanaces, that are particularly wanted for this use.

Little fish of the prickleback, thornback, and other similar kinds, may also probably be employed in the same way, with equal benefit and advantage, where they can be had in sufficient quantities.

STICKLER, in our Old Writers, an inferior officer, who cuts wood within the king's parks of Clarendon.

STICKNA, in Geography, a town of Bohemia, in the circle of Prachatitz; 5 miles S. of Strakonitz.

STICKS, Foot, in Printing, slips of wood that lie between the foot of the page and the chafe, to which they are wedged fast by the quoins, to keep the form firm, in conjunction with the side-ricks, which are placed at the side of the page, and fixed in the same manner by means of quoins. See REOLET.

STICTA, in Botany, from ektos, dotted, alluding to the minute impressions on the under side of the frond; a name given by Schreber to one of the sections into which he proposes to divide the Linnean genus of Lichen, which is now received as a genus by itself, like Stereocaulon, Spiroma, &c. (See those articles.)—Schreb. Gen. 768. Achar. Meth. 375. Lichenogr. 86. t. 8. f. 1.—8. Syn. 230. Cliffs and order, Cryptogamia Algæ. Nat. Ord. Lichens.

Eff. Ch. Shields orbicular, flat, felisile, with an elevated border of the substanace of the frond, scattered. Frond coriaceous; downy beneath, flammed with little bald pits. One of the most interesting of this natural order, found on old trees in various parts of the globe. The species in the Synoos of Acharius amount to twenty-two, of which seven are British; but the last in this list, S. Hyssastis, is not unattainted with doubt, and another is certainly misplaced, as we shall mention hereafter. We select a few of the most remarkable exotic, in addition to our native species.


—Found on trunks of trees in New Zealand, from whence Mr. Menzies brought our specimens. The fronds are three or four inches in length, or height, for we know not whether they grow erect or horizontally, and consist of numerous, very elegant, rounded, flattened, finely pinnatifid lobes, lying over each other. The upper surface is quite smooth, even, and veined, of a pale greenish-glaucous ash-colour, beprinkled with small, slightly elevated, flat fields, red when young, then chestnut-coloured; their border tawny, smooth, slightly crenate at the inner edge. The under side of the frond is yellowish or tawny, paler towards the extremities, and scarcely downy, except about the remarkably strong, brown, elevated, central rib, which run down into a sort of channelled common stalk. The pits, cyphelle, have an elevated polished border, raised above the smooth back of the frond, not funk, as usual in other species, amongst downy or pubescence.

S. comenita. Fringed Stichia. Ach. Syn. n. 2. Meth. 276. t. 5. f. 1. —Frond dilated, greenish-white, with wedge-shaped, somewhat forked lobes; pungent beneath, with cup-shaped pits. Shields tawny-red, fringed, like the frond, with radiating black hairs. —Gathered by Dombey on trees in Peru. One of his specimens was given us by M. L'Heritié, a remarkably handsome species, larger than the last, spreading in broad imbricated malles, and differing by the copious large red fields, bordered with black spreading hairs. The pits of the under surface are, in fact, pale brown-ovulate cups, imbedded in dense pungent pubescence of the same hue.

S. crocata. Yellow-veined Stichia. Ach. Syn. n. 6. (Lichen crocatus; Linn. Mant. 310. Dickf. H. Sicc. falc. 4. 84. Engl. Bot. t. 2110.) —Frond roundly lobed, dilated, cellular, glaucous-brown, with bright-yellow powdery cracks and margins; brown and pungent beneath, with minute bright-yellow pits. Shields dark-brown, with an entire border. Native of rocks, and trunks of old trees, in the Highlands of Scotland, as well as in the East and West Indies. The dark livid hue of the wrinkled cellular frond, strikingly contrasted with the lemon-coloured powder, which flours from all the cracks, edges, and walls. The pungent down of the under side is nearly as dark, though somewhat reddish; and the pits, though very minute, are rendered conspicuous by their bright lemon-colour. We never saw the shields. —Acharius misapplies to this the synonym of Dillemius that belongs to the following.

S. aurata. Golden-edged Stichia. Ach. Meth. 277. Syn. n. 7. (Lichen auratus; Engl. Bot. t. 2359. Platinum crocatum; Hoffm. Pl. Lich. v. 2. 52. t. 38. f. 1.—3. Lichenes lacunolus crotulum, marginibus flavis; Dill. Mufc. 549. t. 84. f. 12.) —Frond fringed, roundly lobed, nearly even, of a shining reddish-glaucous bright brown; the margin wavy, bearing golden-coloured powder; brown and downy beneath, with bright-yellow pits. Shields ...... Native of trees in St. Helena and the West Indies, possibly also of Devonshire; but the authority for the latter depends on unmarked specimens, found in Mr. Hudson's British herbarium. This was first distinguished from the last, by the writer of the present article, in Engl. Bot. v. 33. There can be no doubt of its being abundantly different, the paler redder colour of the upper side, and want of veins, wavy cracks, or cellular defformities, are sufficient characters.

The margin is more timid and wavy, with a rather more golden than lemon-coloured powder, which line also appears in the inner substanace of the frond, when broken, and in the minute pits of its brown under side. Nothing is known of the fields.

of the earlier botanists, and given rise to the name. The
colour of the upper surface, when fresh and moist, is a rich
bright green, verging towards olive, or brown by age or
drying. Its very prominent reticulations, usually smooth,
are occasionally rough with warts, or rather minute fibres.
The under side is downy, pale-brown; in an early flute
quite even, though marked with broad, oval, perfectly
smooth, and rather shining, spaces, apparently analogous
to the pits of other species, and therefore, in our opinion, justi-
fying the removal of this plant to the present genus, with
which it, no doubt, in every other respect, strictly accords.
These spaces become afterwards humid, and very prominent,
between the downy depressions, which answer to the ribs,
or reticulations, above. The shields are frequent, for the
most part seated on the margin, more rarely on the ribs of
the dill, flat, of a chefon-brown, with a narrow border
disappearing with age, when also the shields sometimes
become humid and convex. The resemblance of this plant
to the lungs, has caused it to be used, in a decoction with
milk, to cure coughs. It is bitter, astringent and mucil-
ginous, like the famous Iceland Mols, Lichen islandicus of
Linnæus, and may therefore agree with that species, in
whatever respects the latter may possess.

S. frorobiculata. Pitted Sticta. Ach. Syn. n. 13. (Par-
meia frorobiculata; Ach. Meth. 219. Liches frorobiculus;
L. verruculosus; Hudf. 545. Jacq. Coll. v. 4. 278. t. 18.
f. 17. Lichenes polunomen villum, superficie frorobi-
culata et peltata; Dill. Mufc. 216. f. 29. f. 114.)—Frond
dilated, rounded lobed, crinate, deeply cellular, obtusely
reticulated, glaucous, with grey mealy warts; brown
and villous beneath, with pale, ovate, smooth spaces. Shields
small, scattered, chefon, with a roughish border.—Found
in the mountainous parts of Europe, on trees and mossy
rocks, but rarely in fruticification. We met with it in this
state, but sparingly, near Lakes, on the beautiful shore of
Loch Lomond. This has much broader rounded lobes than
the foregoing, spreading loosely in large patches; the pale
yellowish, ferrugineous, and grey, if it is not covered with
a surface, though deeply cellular, is scarcely ribbed or reti-
culated. Grey mealy warts, looking like a fort of mould-
seal, occur towards the edges of old plants; and the shields,
when fresh, are feasted more towards the central part of
each lobe. The under side is clothed with dark-brown
spiny-downs, vanishing near the edge, and interperled with
oval, whitish, very smooth spots, evidently of the nature of
real cypella, though still so much resembling what we have
described in S. polunomus, as to confirm the genus
of that species.

Syn. n. 20. (Lichen limbatas; Engl. Bot. t. 1104.
Lichenes, Dill. Mufc. 108. t. 26. f. 100. varietas far-
ifolosa, B.C.)—Frond rounded lobed, glaucous-brown, smooth;
grey and powdery towards the margin; downy beneath,
with white cup-shaped pits. Shields brown, with a dark
border.—Native of shady mossy rocks, and about the roots
of trees, in Scotland, Wales, Oxfordshire, and, according
to Acharium, in Switzerland. We have a specimen with nu-
umerous shields, which are extremely rare, from Mr. Huddon's
herbarium, and another from Mr. Meunier. Much smaller
than the last, each plant rarely exceeding two inches
in diameter, and consisting of a few concentric, lax, rounded
lobes; whose upper surface is smooth and shining, emulating
brown fatti, with scarcely any depressions and reticulations;
the margin only, often tumid and repressed, being rugged,
and covered with grey mealy warts, proceeding from cracks
in the cuticle. The under side is even, of a nearly uniform
light brown, finely downy, besprinkled with small, white,
smooth, bordered pils, sunk in the down. Shields small,
seifile, with a broad base; their disk dark-brown, at first
concave, with an elevated, smooth, thick border, but soon
becoming flat, or slightly convex, almost black, the border
assuming the same hue. This border is not sufficiently ex-
dited in Engel. Bot. Neither Lichenus nor Acharium ever
saw the shields, and hence the former was led to look his
very distinct species to be the male, or "powder-bearing plant,"
of what we shall next describe, both having been for the
first time clearly determined in the Engl. Bot. from spec-
cimens collected and studied with no small care and at-
tention.

n. 21. (Lichen fuliginosus; Dickf. Crypt. facic. t. 13.
Engl. Bot. t. 1103. Lichenoides fuliginnosum et pulvu-
rentenium, frutellis rubiginosis; Dill. Mufc. 198. t. 26. f. 106.
116.)—Frond rounded lobed, dark greenish-grey, rough with
blackish granulations; downy beneath, with white cup-
shaped pits. Shields red-brown, with a pale border.—More
frequent than the last on rocks, as well as trees in old dark
woods, in the alpine countries of Europe. Acharius says
it grows also in France, America, and the isle of Bourbon.
We have it from Cornwall, Wales, and Wexford.
The size and habit of this plant agree with the last, but the
present species is distinguished by the innumerable dark
warty granulations of its upper surface, and the want of
those gray, dense, mealy warts, which distinguish S. limba-
as. The under sides of both species are similar. The shields
of the present, very rarely met with, are more elevated; at first
reddish, with a pale tumid border; and convex and dark
brown, their border disappearing. This has been very
erroneously confused as a variety of the following.

Pl. Lich. v. 21. t. 4. f. 2. Lichenes polychydes, villusum et scabrum, pelta parvis; Dill. Mufc. 195. t. 27.
46.)—Frond deeply lobed, dark greenish-brown, somewhat uneven and granulated; downy
beneath, with white pits. Shields marginal, vertical, con-
 vex, dark-brown.—Abundant in the mountainous woods of
most parts of Europe, clothing the ground in loose extensive
tuffs, intermixed with moss, under the shade of rocks or
old decaying trees; but the fruticification is among the
greatest botanical rarities. We have seen it however in
Dr. Hope's collection, who received his specimen from Dr.
Burges of Dumfriesshire: Dillenius and Hoffmann have
also delineated similar ones. The fronds spread much more
widely than those of S. limbatas or fuligina, and are longer,
though narrower and much more divided, with abrupt
divaricated segments. Their upper surface is usually
smooth and even, of a greenish-brown, scarcely so
green as in Hoffmann's plate. Sometimes it is obscurely
cellular, and besprinkled with dark granulations, like those of
fuligina; with which species likewise the under side
accords, the pits being those of a true Sittta. But the
fuligina, as represented by authors, appear very different
from all known species, being more like the male, and the
targets, of the genus Peltides, and treated, like most of them,
on marginal elongated portions of the frond. (See Pel-
tides.) Whether they are orbicular and bordered in a young state,
nobody has observed. If so, this ambiguous species would
prove a genuine Sittta; but otherwise it would, as a Pel-
tides, overturn the importance of the cypella for generic
distinction. Indeed this importance is much weakened
by
S. palumbosus and S. scrobiculata, in which these pits are so imperfectly defined; to say nothing of Parmelia glomulifera, Aech. Syn. 195. (Lichen glomulifera; Engli. Bot. t. 293) and other species, in which they distinctly, though but occasionally or sparingly, occur.

We beg leave, further, to observe that S. dissoluta, Aech. Syn. n. 19, has no character of the present genus, but, though.handle on both sides, seems naturally of the tribe called Cataria.

STIECHOWITZ, in Geography, a town of Bohemia, in the circle of Beraun, in the Muldau; 10 miles S.E. of Beraun.

STIEGE, or Stieg, in Commerce, a term of reckoning used in Germany, containing 20 pieces.

STIENNA, in Geography, a town of Italy, in the department of the Lower Po; 9 miles N. of Ferrara.

STIEPANOW, a town of Bohemia, in the circle of Kauzma; 15 miles S. of Kauzma.

STERNHELM, George, in Biography, a learned Swede, was born in Dalecarlia, in the year 1598. Enjoying the friendship of Burans, tutor to Gustavus Adolphus, he made great progress in literature and the sciences. Upon his return from a tour into foreign countries, he was appointed lecturer on morality in the gymnasium newly founded at Vetteros; but defined for a wider sphere of usefulness and reputation, he was appointed, in 1630, aforesaid in the court of justice at Dorpat; and in the following year he was ennobled. In 1654 he occupied an important office in Livonia, where it was his fate to be regarded by the ignorant and superfluous populace as a forerunner, because he employed microscopes, and other philosophical instruments, to aid him in the investigation of the secrets of nature. In 1648 he was advanced to the high station of vice-president of the court of justice of Dorpat; but being obliged to fly from the Ruffians, who threatened his person, the vessel in which he embarked was wrecked in its passage; and though he escaped himself, he lost all the property which he had preferred from the ravages of the Ruffians. When he arrived at the capital, he was penniless and almost naked; but he was soon relieved by the munificence of some fixed friends. Queen Christina treated him with respect; and nominated him antiquary of the kingdom; entrusting him also with the care of the public records, and conferring on him the title of "Custos Regni." In 1658 he was appointed by Charles X. provincial judge of Drontheim, in Norway; but when Drontheim was restored to Denmark, he became, in 1661, a member of the council of war; and when the college of antiquities was established at Upal, in 1665, he was appointed director. He died at Stockholm in 1673, at the age of 74. Sternhelm was a man of great learning, and excelled in an extensive knowledge of languages. All languages, in his opinion, were derived from the Scythian, which he maintained to be older than the Hebrew itself. By command of queen Christina, he was obliged, in her presence, and in the public hall of the academy of Upal, to hold a dispute on this subject with professor, afterwards bishop, Terlerus. His taste for poetry led him to an acquaintance with the principal compositions of the ancient poets; and his own verses are said to have been read with pleasure. In consequence of his extensive knowledge of mathematics and arithmetic, he was employed to regulate the Swedish weights and measures. Regardless of wealth, he was often reduced to such distresses as to be under a necessity of writing to the chancellor Oxenstierna, requesting public relief. When his friends regretted his poverty, they received for answer, "Bona mentis comes eft properas. Aut philosophum aut divitem oportet vivere." He preferred the former; and always seemed contented, cheerful, and happy. Being asked on his death-bed what epitaph should be inscribed on his tomb, he replied, "Vixit, dum Vixit, letus." Although he was a man of unquestionable virtue and integrity, he did not escape calumny. In matters of philosophy, he thought freely and boldly; but it does not appear that he ever wrote anything contrary to that respect which is due to the Supreme Being, or to the principles of true religion. Among his numerous works were, "Magog Aramaz Gothicus, five origines Vocabularum in Linguas pane omnibus, ex Lingua Svetica veteri"; a work printed at Upal in 410. but never completed; "Lugogo Veytrogthiche antiques, cum Prefatione et Indice Vocabularum obscuroserum," Stock. 1653, fol. ["Uphilas, iut Verfo quator Evangeliorum Gothica, Litteris Latinis quam Gothicas ediderat F. Junius, cum Ver Lombus parallela, Vexogthica, Illustris, et vulgata Latina," etc., 1617; ibid., 410.]; "Epilola ad Olaus Verelium de Origine Vocabularum Gothi et Srdi," pre-fixed to Hervara Saga; "Antiquiuerus, five de Originius Sveo-Gothicia," Holm. 1687, 8vo. The "Archiomph Reformatus" of Sternhelm, on trying metals by water; and his "Linea Carolina," are incontrovertible proofs of his deep knowledge in mathematics and natural philosophy. It appears that he had both microscopes and lenses, which were very rare in Sweden at this time. He was well versed in languages, history, and the northern antiquities. His memory was particularly cultivated on account of his being the father of true poetry in Sweden. He determined, as his biographer says, to throw aside that restraint which words of the same sound at the conclusion of the lines carry with them, and to try whether ingenious thoughts would not please as much in Swedish verse without rhyme, as in the poetry of the Greeks and the Romans. The attempt completely succeeded in hexameter or heroic verse, and Sternhelm's "Hercules" is and will continue to be a master-piece. Gen. Biog.

STIERNHOOK, Justus, a learned Swede, was born in 1576. After travelling in foreign countries from 1620 to 1624, he was appointed lecturer of jurisprudence and the political sciences at Vetteros; and in 1640 made professor of jurisprudence in the newly established academy at Abo. In 1658 his fight became bad, and he laboured under this infirmity until his death, which happened at Stockholm in 1675; and yet two years before this event he went to Holland, and visited the Hague, Leyden, Amsterdam, and several other parts, without any assistance. He was the author of various esteemed works, among which was "De Jure Syenum et Gothorum vetus Libri duo," Holm. 1672, 4to. Gen. Biog.

STIFF, the quality by which a ship is enabled to carry a sufficient quantity of sail without the danger of overfling. Vessels having this quality, arising from their construction, will certainly sail faster than others, which, in order to carry the same quantity of sail, require to be ballasted. The raffines of many ships, however perfect in their construction, may be materially injured by an injudicious mode of fowing; although, on the contrary, this excellence of the construction can be fet by rigid and rectified, to any considerable degree, by the fowing. See Ship-building, and Stowage.

STIFF JOINT, in neat cattle, a disease of these parts, which is often troublesome and very hurtful to them. It is most probably the rheumatic kind, and not unfrequently termed joint fallen by the country people.

It affects, for the most part, such old milk cows as are near calving, or such young cattle as are much exposed in the
the field in the spring of the year. It commonly arises from too great exposure to cold winds and moisture, and generally takes place in such animals as have been kept in a state of poverty and starvation for the winter fea¬son, on their being suddenly turned out in the early vernal months, and greatly exposed in low dews to situations to the severity of the north and easterly winds.

The appearances of it are, that the joints become particularly affected, and sometimes swelled; and there are great pain and weakness. For two or three days at first, the animals only appear stiff in the joints; which afterwards often begin to tumefy and enlarge, without any signs of an active inflammatory state; a cold inactive tumour consequent takes place about the articulations, which is attended with a great stiffness, that not unfrequently spreads and extends itself over the whole body, so that the beast is scarcely able to rise when laid down, without being in some measure afflicted. Such cattle as labour under this complaint often suffer greatly from the severity of the pain in the parts, and from the little leisure and incapability of stirring which attend it.

On the diseased first making its appearance, the beast should be removed, and be taken to some proper building of the cow-house kind, which is rather warmly situated, as moderate warmth is of much use in the removal of the complaint. Here proper remedies should be given, such as colostrum and gum guaiacum, in pretty full doses, as from half a drachm, to a whole drachm and upwards, of the former; and from half an ounce, to an ounce and more, of the latter, in powder, made up with the tincture of opium and balsam of copaiva into the form of a small ball. This may be given once or twice in the day, in a horrid or two of warm ale. And afterwards, recourse may be had to guaiacum, in combination with Peruvian or oak bark, camphor, and fomachic feeds, in the proportions of from one to two ounces of the gum, bark, and feeds; and from one and a half to two and three quarters of the cumin; the whole being formed into a fine powder, and given as above.

One or two ounces of the spirit of turpentine may also sometimes be given in a quart of thin oatmeal gruel with great benefit.

The use of strong stimulating applications rubbed externally on the swellings of the joints, which are so strongly recommended by some, are seldom probably to be had recourse to, as they may be attended with danger in many ways.

Where the diseased puts on an active state, and is accompanied with fever and much pain, as well as swelling in the joints, as occasionally is the case; it will be necessary and proper to have recourse to opening mild purgative remedies, as there may be occasion, with the balls and powders given in such a manner as may be suitable.

By the proper use of these means, the beasts will most likely soon get well of such stiffnesses in their joints.

But cows and other cattle sometimes have lamenesses and stiffnesses, which appear to be at one time in the fore-quarters, and at another in the hind ones; and which may be attended with considerable pain. These are often removed by hard driving, or other similar cau¬ses, and nut from the same causes as the above; but in these cases, too, the colostrum, as well as such remedies of the bark kind as have been advised above, will be found useful.

**Stiff Joints** in lambs, a diseased or afebrile in these parts of them, which mostly takes place during the hot summer season, as about the month of June, coming on with a stiffness in the different joints of the extremities, and sometimes seizing several lambs in the same flock at the same time. It is commonly supposed to be occasioned by the low state or condition of the eves to which they belong; but it is more probable that it arises from the sudden night colds and dampness which are liable to take place, and to which they are particularly exposed during this period of the year. At such times, however, the lambs are believed to be disposed to grow fast, and, for want of proper and sufficient nourishment, to become floured, and to have their joints stiff and swelling out; they, however, for the most part, recover of the complaint. It is most likely a disease of the rheumatic kind, which, when it does not readily go off, may give way to the use of calomel with a little opium in the form of a small ball, to the extent of from a scruple to half a drachm, once or twice in the day, or a small spoonful or two at a time of the spirit of turpentine.

**STIFLE, or STIFFLE.** The name of a diseased in the patella, or knee-pain, in a horse or other animal, which part it properly signifies. A lameness in the stiffle is caused by those accidents that produce it in all other joints. When a horse is lame in this part he generally treads upon his toe, and cannot feel that heel to the ground. Some strains in the stiffle are violent, and swell pretty much; but Gibson affirms, that he hardly ever knew any of them incurable, unless bad methods had been used in the beginning. They commonly may be cured by cooling fomentative applications, such as have already been prescribed for the above; but if the swelling be very large and puffy, which sometimes happens, recourse must be had to fomentations, to take off inflammation. Sometimes, however, imposthumations follow: in such cases, and when these break and run, there is commonly an end of danger.

**STIFT,** in Etching. See Etching.

**STIGLIANO,** in Geography, a town of Italy, in the Patrimonio; 9 miles E. of Civita Vecchia.—Also, a town of Naples, in Basilicata, celebrated for its baths; 24 miles S. E. of Acerenza.

**STIGMA,** in Medicine, a minute red speck in the skin, without any elevation of the cuticle, of the same nature as petechia, from which they differ only in magnitude.

**STIGMA,** in Botany and Vegetable Physiology, an essential part of the Pistillum (see that article) in flowers, being the organ defined to receive the Pollen, the action of which upon the stigma causes the fertility of the seeds. (See **FECULATION OF PLANTS**.) For the accomplishment of this important purpose, the part is situated so as to receive the pollen, and so formed as to retain it; whilst a peculiar moisture, secreted, more or less copiously, by the stigma, occasions the particles of the pollen, hitherto kept dry, to burst, and discharge their elastic contents, more immediately subservient to the end designed. When the pollen is of a glutinous quality, as in Orchis and Conotis, the same moisture must be supposed to act as a menstruum, performing the same thing in a slightly different mode.

The shape of the stigma is either simple, being little more than a mere point; or it is capitate, like a pin’s head, as in the Primrose. In the ringed flowers the two stigmas are typically simple, but of the most simple structure, devoid of all evident pubescence, so that it is hard to understand which is the efficient part; whilst in most gramineous the stigmas are amply branched or feathery, to detain the pollen. So in many of the mallow tribe, a great degree of pubescence, and abundance of viscid moisture, are evident in these organs; their rich purple or scarlet colour contrasting with the large yellow pollen, whole burring, or explosion, may almost be seen by the naked eye. The stigma of the Amsyllis formosa is furnished, as Linnéus observes in his
Differtation on the Sexes of Plants, with a large drop of clear fluid, which is protruded in the day time, fo as to seem in danger of falling to the ground. To this the pollen adheres, rendering it turbid or firefly, in which state it is re-absorbed towards evening into the style. The concave stigma of the Violet grapes to receive the pollen; that of the Marjoram is flatter to be insertible, clotting from the stimulus of the pollen, which by that means it more freely retains. That a vital principle is inherent in the stigma, at least till the ends of its formation are answered, we learn from an observation of Linnaeus, in the Differtation above alluded to. He found that this organ, in female plants of Hemp to which no pollen had access, remained for a long while green and vigorous, as not having had the vital principle exhausted; while the stigma of every blossom which had been impregnated, evinced the completion of that operation, by fading and withering away. Almost every flower, when carefully examined, confirms the truth of this remark. In those cases where the styles remain, to form a crown, or hooks, affixing in the dispersion of the seeds, the stigmas will generally be found decayed or separated. See GERMEN and STYLUS.

STIGMANTHUS, in Botany, a name of Loureiro’s, formed of *stigma*, the stigma, and *anthos*, a flower, in allusion to the unusually large size of that organ.—Loureiro, Cochin. 145. Clasts and *Pentandria Monogynia*, Nat. Ord. A. Rhamn. Juf. Gen. Ch. Cal. Perianth superior, of one leaf; tube short; limb in five deep, long, very slender, segments. Cor. funnel-shaped, with a long tube; limb in five deep, ovate-oblung, spreading segments. Stam. Filaments five, very short, inserted below the segments of the corolla; anthers oblong, reflexed (we presume between the segments). Fil. Gernen inferior, roundish; style thread-shaped, longer than the corolla; stigma ovate, furrowed, very large. Peric. Berry dry, compressed, tuberculated, of one cell. Seeds numerous, oblong, angular, bony. Eff. Ch. Corolla funnel-shaped. Stigma furrowed, very large. Berry dry, crowned by the calyx, of one cell, with many bony seeds.

1. *S. cyphiodes*. Cay buim of the Cochinchinae.—Native of woods and hills in Cochinchina.—A large, branching, climbing shrub, within tendrils or thorns. Leaves opposite, lanceolate, entire, smooth. Flowers white, in very large, axillary and terminal, cymes.

Loureiro hints the affinity of this plant to *Mussanda*, from which, he says, it differs chiefly in its seed-veil and stigma. We cannot refer it to any known genus, but it seems to range near the SOLERA of Willdenow. See that article.

STIGMAROTA, from *figma*, and *rota*, a wheel, alluding to the large, orbicular, toothed figma.—Loureiro. Cochin. 633.—Clasts and order, *Dicta Polyantria*. The name is bad, and of the genus itself we have not sufficient materials to form an opinion. Loureiro gives the following. Eff. Ch. Male, Calyx in four or five deep segements. Corolla none. Stamens thirty. Female, Calyx in five or five deep segments. Corolla none. Stigma wheel-shaped, five-lobed. Berry fleshy, with five seeds. The species are two.

1. *S. Jangomas*.—Stem arboreous, with branched spines. Stalks scattered, many-flowered.—Cultivated, and perhaps wild, in Cochinchina. This the author considers as *Jangomas*, Bont. Jay. 111, and *Spina Spinaria*, Rumph. Amboin. v. 7. 36. t. 19. f. 1, 2. He therefore rightly observes, that the latter synonym can have no reference to *Carissa Spinaria*, Linn. Mant. 559.

2. *S. africana*. Stem shrubby, with simple spines. Flowers solitary, terminal.

STIGMATA, in Natural History, the apertures in different parts of the bodies of insects communicating with the tracheae, or air-veils, and serving for the office of respiration. Nature has given to these minute animals a much larger number of tracheae and bronchia, than to us. We have the ramifications of the tracheae reaching no farther than into the breast, whereas, in the bodies of these insects, we find them extended through the whole, and finely and admirably interlaced with one another. We have but one mouth to expire by; and the organization of the parts, inertive to respiration, is very admirable in us; but in the insect class, the mouths or openings to breathe at, are much more numerous, and the organization much more complex.

All the two-winged and four-winged flies, which have a single or undivided corselet, to which their legs are all fixed, have also four figmata in that corselet, two on each side. They have them also on the rings of their body, but those on the corselet are the most considerable.

Of the four on the corselet, the two anterior ones are usually the largest. The bell way to find them, in the generality of flies, is to examine them first in the larger species of the libelle, where they are very distinct and plain, and after their situation is well known in that species, they will be found the more readily found in the rest.

These figmata of the corselet, as well the anterior, as the posterior, are oblong, and placed obliquely to the length of the body; that end of them next the head is more elevated than the other, and their size is sufficiently large to render them visible, especially the first pair. Each of these seems not a little to resemble a fasc-mucle with its shell a little open, or is somewhat like the opening of an eye. It is also surrounded by two eye-lds, proportionally thick; and beside these, which make its outer circumference, one may discover two others within, which are bordered with hair and which, when closed, often quite shut up the opening.

The colour of the figmata often is some help also to us for the discovery of them; they are very frequently different in colour from the corselet; some are yellowish, others of a coffee colour, or some degree of a yellow colour, in flies whose corselet is brown, or black, or blueish.

Flies have, beside these, several figmata also in the rings of their bodies, perhaps in every one of them, though commonly those in the two or three first are only to be distinguished; these are not like those of the corselet, but are round, usually a little eminent above the rest of the surface, and resembling pins’ heads; they are not easily discovered, because they are not only small, but usually hid by the folds, or convolutions of the rings. They are usually two on each ring, placed on the two opposite sides, and partly under the belly, Reaumur, Hist. In. vol. iv. p. 248.

Malpighi first discovered, that those eighteen openings, which are placed nine on each side of the caterpillar, and which are called by the name of figmata, serve to give respiration to this class of animals. M. Reaumur repeated his experiments, and made several new ones; and he concluded that these apertures served only for the inspiration of the air, which the caterpillar afterwards expired through the whole superficies of its body, because he could never observe that any bubbles of air were ever driven out of these figmata; but Mr. Bonnet, on the contrary, having seen bubbles of air coming out of these openings, was led to infer that the inspired air was also expired or discharged through these same orifices; and he is of opinion that no part
part of it is expired through the pores of the body. From several experiments he also inferred, that of the eighteen stigmata with which the caterpillar is furnished, the two anterior and the two posterior ones are of greater use for respiration than any of the others. Phil. Trans. vol. xlv. p. 300. &c.

STIGMATA, in Antiquity, certain marks impressed on the left shoulder of the soldiers when lifted. See STIGMATIZING.

STIGMATA is also a kind of notes, or abbreviations, consisting only of points, disposed various ways; as in triangles, squares, crosses, &c.

STIGMATA is also a term introduced by the Franciscans to express the manner or prints, of our Saviour's wounds, said to have been miraculously impressed by him on the body of their seraphic father, St. Francis.

A solemn feast was hereupon appointed to be annually celebrated in memory of the miracle, called "the feast of the stigmata of St. Francis!" and a peculiar mass or office was composed for the same.

An archi-confraternity was erected on the feast occasion, by Fr. F. Pizzetti, a Roman surgeon, in the year 1594.

STIGMATICI, among the Romans, were servitors marked for the crime of sacrilege.

STIGMATIZING, among the Ancients, was inflicted upon slaves as a punishment, but more frequently as a mark to know them by; in which case it was done by applying a red-hot iron, marked with certain letters, forming the name or some peculiar character belonging to their masters, to their foreheads till a fair impression was made, and then pouring ink into the furrows, that the inscription might be the more conspicuous.

Soldiers were branded in the hand with the name or character of their general.

After the same manner it was customary to stigmatize the worshipers and votaries of some of the gods. The marks used on these occasions were various; sometimes they contained the name of the god, sometimes his particular enigma, as the thunderbolt of Jupiter, the trident of Neptune, the Ivy of Bacchus, &c. or they marked themselves with some mythical number, by which the god's name was described. To these three ways of stigmatizing St. John is supposed to refer. (Rev. chap. xiii. ver. 16, 17.) Theodoret is of opinion, that the Jews were forbidden to brand themselves with the name of a god, for their being in a state of war; but it is certain, they used to consecrate themselves to their gods.

Among some nations, stigmatizing was considered as a distinguisughed mark of honour and nobility. In Thrace, as Herodotus tells us (lib. v.), it was practised both by perfons of credit, nor admitted by any but persons of the meanest rank.

The ancient Britons are also said to have impressed on the bodies of their infants the figures of animals, and other marks, with hot irons. Potter Arch. Grec. tom. i. p. 64, &c.

STIGSIO, in Geography, a town of Sweden, in Angermanland, seated on a river which runs into the gulf of Bethnia; 8 miles W. of Hernofand.

STIKKESHOLM, a place on the south coast of Iceland, situated at the extremity of a small peninsula, close to the sea, amidit abruptly precipitous rocks, some of which are columnar. Near the ilthmus, which is passed in entering this peninsula, is a hamlet, called "Heigæli," or the Holy Hill, from its situation on an eminence, with which certain superstitious ideas and usages were anceintly connected. On this spot was established one of the earliest of those settlements which the Norwegian emigrants made upon the coasts of Iceland. The access to Stikkeholm affords several fine views of the "Breidé-Fjord," which is here completely flooded with small rocky islands, amounting in number to about 150. Many of these islands contain the great numbers of eider-ducks. The houses are large, and, as well as the store-houses and cottages, belonged (in 1810) to Mr. Thorlacius, a native of the country, and reputed the richest man in Iceland. Before the war between England and Denmark, Stikkeholm was a place of considerable traffic. The fishery, which begins earlier than in the Faxé-Fjord, was very productive. During the early part of Sunday, the occupations of the people in this place were suspended, and many of them went to the neighbouring church at Hlegæli; but at six o'clock in the evening, the store-houses were again opened, and the inhabitants of the place, renewing their common drees, went to work as usual. This is also the case in every part of the country. The Sabbath of the Icelanders, according to the ecclesiastical law of the island, begins at six o'clock on Saturday evening, and terminates at the same hour on Sunday. The females of the family at Stikkeholm, as well as those of the higher classes of people in other places, did not sit at the table, when the travellers, to whose account we now refer, were eating with the men. The master of the house always served his lady when he rose from the table. Mackenzies Travels in Iceland in 1810.

STIL de Grain, in the Colour Trade, the name of a composition used for painting in oil or water, and is made of a decoction of the lycium, or Arvigion berry, in alum-water, which is mixed with whitening into a paste, and formed into twisted sticks. It ought to be chosen of a fine gold yellow, very fine, tender, and friable, and free from dirt.

STILAGO, in Botany, Linn. Mant. 16. Juff. 445. Stilago. Gen. 608. 836. Wildl. Sp. Pl. v. 4. 714. Mart. Mill. Dict. v. 4. Alt. Hort. Kew. v. 5. 367. was so called perhaps from the supjectory permanency of its stily. The name and the genus, however, require to be abolished, the characters, except that of the berry from Rumphius, having been taken from a specimen in the Linnean herbarium, which proves merely the male plant of Antidysma axilasteria. (See Antidysma.) Indeed the Stilago diantha, Roxb.Coromand. v. 2. t. 166, most evidently agrees in genus with his Antidysma polycarpa, t. 167. We cannot without rigour, for their being described by the learned author, who well knew what Stilago was. Still more wonderful is it that Norli tal, Rheede Hort. Malab. v. 4. t. 66, should be quoted by Willdenow, without any remark, for both Stilago Bunius and Antidysma axilasteria. We cannot deny the accidental propriety of this citation, they being, though the author did not know it, one and the same plant.

STILARO, in Geography, a river of Naples, which runs into the gulf of Squillace, N. lat. 38° 21'. E. long. 16° 50'.


Gen. Ch. Cal. Pernier inferior, double; the outer of three lanceolate, spreading, pointed leaves; inner of one leaf, tubular, five-toothed, at length hardened. Cor. of one petal, funnel-shaped; tube the length of the calyx; limb
limb in four or five linear-lanceolate, nearly equal, deep segments. Stem. Filaments four,awl-shaped, inserted into the throat of the tube, longer than the limb, somewhat unequal in length; anthers heart-shaped, obtuse. Fi Gill. German superior, ovate; style thread-shaped, the length of the filaments; stigma acute. Pedic. none, except the inner calyx become cartilaginous, inclining the leaf, and falling off with it. Seed solitary.

Some plants are said to bear only male flowers.

EFl. Ch. Calyx inferior, double; the outer of three leaves; inner five-toothed, cartilaginous. Corolla funnel-shaped. Capsule of one cell and one valve, separating entire from the base. Seed solitary.

1. S. piniflora. Fine-leaved Stilbe. Linn. Mant. 305. Wild. n. 1. Thunb. Prodr. 29. (S. verbita; Berg. Cap. 30. t. 4. f. 6. Selago piniflora; Linn. Sp. Pl. 876.)—Leaves lanceolate, pungent, revolute. Spikes erect. Limb of the corolla hairy.—Native of the banks of rivulets, at the Cape of Good Hope. It seems unknown in the gardens of Europe. Commelin's Veterinella, Hort. Amst. v. 2. t. 110, barely can have nothing to do with this plant. The flower is thin, with many bright round, small, white flowers, densely clothed with whorled, spreading, ascending, rigid, pale, lanceolate, revolute, entire, smooth leaves, half an inch or more in length; dotted above; on short broad stalks. Spikes terminal, sessile, solitary, erect, obtuse, long; with a bracteas under each flower, resembling the leaves, but shorter and broader. We have never seen the flowers in perfection, which Bergius describes as white. We are not without suspicion of his having, as well as Linnaeus, confounded two species, one with longer whitish hairs upon the corolla, and shorter less pungent leaves, than what his plate represents.

2. S. ervus. Drooping Stilbe. Linn. Suppl. 441. Wild. n. 2. Thunb. Prodr. 29.—Leaves prismatic, abrupt, with a small point. Spikes drooping. Limb of the corolla smooth.—Gathered by Thunberg, at the Cape of Good Hope. The leaves are only four in each whorl, not fix, as is the foregoing. Their form is triangular or prismatic, with a funk rib. Spikes shorter than the leaf, recurved, with much larger flowers, whose limb has only four segments, all smooth, lanceolate, and acute.

3. S. ericoides. Heath-leaved Stilbe. Linn. Mant. 305. Wild. n. 3. Thunb. Prodr. 29. (Selago ericoides; Linn. Mant. 87.)—Leaves ovate. Spikes erect. Limb of the corolla smooth.—Native of the Cape of Good Hope. A much smaller floribunda than either of the preceding, with small leaves, like some Heath or Thyme, imbricated in four rows, ovate, thick, smooth, with a fangular lanceolate keel, lodged in a furrow. Spike short and erect. Flowers apparently pubescent. Calyx fringed with white wool. No figure is extant of this or the last, nor have they appeared in any garden.

STILBITE, in Mineralogy. See ZEOLITE.

The French mineralogists, after Hally, have divided the mineral called zeolite into two species, mesotype and stilbite. The latter is often called nacreous zeolite, being distinguished by its nacre luster. The properties of this mineral will be described, with the other varieties of zeolite, under that article.


This cannot be seen a very doubtful genus of the vegetable kingdom, though not more obscure than the Chaos of Limnæus, or the Hydriid of Hunter, amongst animals. Perfoon remarks that there is no spérum, or capsule receptacle, as in Sphæxia (see that article); and that a compound microscope is necessary for the determination of the different shapes of those minute granular bodies, which he knew not whether to call seel-vèrtje, or seeds, or perhaps but, all forming, to the naked eye, one uniform black mass. He defines six species.

1. S. afterdeoerm. (S. afterdeoerm; Hoffm. Germ. v. 2. t. 13. f. 3.)—Capes fillet.—This appears in the form of variously-shaped black spots, under the cuticle of trees, and is found, under a high magnifier, to contain numerous, compact, radiated bodies, composed of oblong pods, croffing each other, and divided internally into three or four cells.


3. S. ovata. Perf. Obs. Mycol. falc. 1. 31. t. 2. f. 2. (S. pyriform; Hoffm. Germ. v. 2. t. 13. f. 2.)—Capes? or seeds? ovate.—On the trunks of beech. The shape is exactly oval, but no distinct partitions, or cells, are discernible, according to Perfoon, though Hoffman's figure seems to express them.

4. S. angulata. Perf. Syn. n. 4.—Seeds minute, ovate, inclining to cylindrical. Intermediate between the leaf and the following, nearly agreeing in minuteneas with the latter.

5. S. microserm. Perf. Obs. Mycol. falc. 1. 31. t. 2. f. 3.—Seeds minute, unequally ovate, rather acute at each end.—On branches of beech, or the bark of Betula alba, &c. Various in form, roundish, ovate, or oblong, defficate of partitions.

6. S. sphéroerm. Perf. Obs. Mycol. falc. 1. 31. t. 1. f. 6.—Seeds minute, globoso.—Found on the stems of the Common Reed, Arundo phragmites, appearing to have run out of figurers in the straw, and sometimes collected into round spots.

STILBUM, from stilbe, shining, a genus of fungi, which Perfoon in his Synopt., p. 68c, thus defines. Efl. Ch. Little, talled, mucker-like fungi; with a roundish solid head, at first watersy or gelatinous, becoming generally opaque, or turbid, and it ripens.

He defines sixteen forms, distinguished on rotten wood, of which the most conspicuous and remarkable is the first.

S. birautom. Perf. Dipl. Meth. Fung. 30. Hoffm. Germ. t. 10. f. 2.—Permanent. Stalk yellowish, rough with straight upright hairs.—A pretty species, found rarely on rotten trunks of trees. This is among the largest of its genus, and may even be dried and preserved. The blisftly aspect of the field, one or two lines in height, readily distinguishes it.

We cannot perceive why this genus may not be comprehended under Micorum. See that article.

STILE, and STILES. See STYLE.

STILE, in Rural Economy, the name of a well-known contrivance for the admission of foot-passengers, without permitting the stock of the inclosures to get through. Stiles are made in very different forms and manners, in different districts, according to the nature of the materials, situations, and purposes for which they are intended. But they may be more clearly understood, by a short description of them. Where stones are in use, a file of a very simple construction is formed, by having at the bottom a thin flat stone set up edge-ways, to prevent sheep, and other small animals, getting out; and above there is a long cross stone or bar fixed, to prevent hores or cattle jumping over. Another file of a simple construction, and which is well calculated
STIL

STIL

calculated for situations where the traffic is not great, is
formed by having stepping-roads fixed in the sides of the wall.
In the Cornish style, the foundation is a stone-wall, in
which a gap is left, and stones are laid across a ditch of
some depth, made lengthways in the gap; the foot-pa-
sengers step on the stones, but four-footed animals miss
them, and fall into the ditch.
Wherever employed in forming files, they have many
different forms, according to the nature of the situ-
tions, and the ingenuity of the workmen who construct
them. Common files of this sort are made with two framed
pieces of timber set upright, part of them parallel to each
other, leaving sufficient space for a passage to pass between
them; and by a fort of upright railing set firmly into the
ground, with steps fixed through it towards the bottom
part, by means of which the passageways are enabled to get
over. There is likewise the wall file, which has some-
what the form of a small gate, swinging between two other
similar frames, which are let fall into the ground in an
angular manner; and the regular step-form, with a rail.
It is probable, too, that there are other different kinds
and forms in use in different places.

STILES, in Carpentry, denote also the upright pieces
which go from the bottom to the top in, any window or,
the like.

STIFREIRED, in Geography, a town of Austria; 7 miles N.E. of Weikendorf.

STILL, an island in the Grecian Archipelago. N. lat. 36° 37' E. long. 27° 40'.

STILICHO, in Biography, a commander who disillu-
ished himself in the decline of the Roman empire, was
of Vandal origin, and the son of an officer of cavalry in the
service of the emperor Valens. Brought up to arms, he
rose rapidly through various gradations to the post of ma-
ner-general of the cavalry and infantry of the Roman,
or at least of the Western empire. He accompanied Theodosius
in all his wars, and maintained the Roman dignity in ratifying
a treaty with the king of Persia. On his return, he married
Serena, the niece and adopted daughter of Theodosius.
Although Rufinus, who was the confidential minister of
Theodosius, was jealous of Stilicho, and wished to deprive
him in the estimation of the emperor, he was counteracted
by the influence of Stilicho's wife; so that he was
with the emperor at the time of his death in 395, and en-
trusted him with the guardianship of his two sons, Ar-
cadius and Honorius. The latter, who had the Western
empire for his share, appointed Stilicho for his prime mi-
nister; and he began his administration by renewing the
ancient alliances of the Romans with the German nations,
and establishing peace. In 398, Stilicho returned to the succour
of Greece, which was ravaged by Alaric. Having either
neglected or betrayed his trust, by suffering Alaric to
escape, he was obliged to withdraw from Greece, and was
declared at Constantinople a public enemy, with confron-
tation of all his estates in the East. Stilicho exerted himself
with vigour in recovering Africa, which had revolted from
the Western empire; and acquired new influence by the
marriage of his daughter, Maria, to the young emperor,
Honorius,—an union elegantly celebrated by Claudian, the
perpetual panegyrist of Stilicho. When the timid Honorius
was alarmed by the irruption of Alaric into Italy in the
year 403, and was disposed to quit Milan, the seat of his
government, and to retire to one of the Gallic provinci-
es, Stilicho opposed this disgraceful measure, and collecting
a powerful force, vanquished the Goths at Pollentia, and
obliged them to retreat: nevertheless Alaric, breaking
through the passage of the Apennines with his cavalry,
spread an alarm that reached even Rome, so that Stilicho
advised the purchase of his retreat from Italy with a sum of
money. When Alaric had finally departed, the policy of
Stilicho was publicly arraigned for suffering him to escape.
In 406, Italy was again invaded by a vast multitude of bar-
barians, who penetrated as far as Florence, laid siege to the
city, and reduced it to great distress. Stilicho hastened to
the relief of the beleaguered, dispersing the barbarians, forced
them to surrender, and put to death their commander,
Radagaisus, who had been taken prisoner. Although
Italy was again delivered by Stilicho, Alaric still remained
at the head of new levies of Goths, and other barbarian
warriors. Stilicho, either from motives of personal aim-
bition, or of state necessity, entered into a negotiation with
Alaric, by virtue of which he was declared master-general
of the Roman armies in Illyricum. While Stilicho was
forming a purpose to lead an army of Romans and Goths
to Constantinople, and conciliating with Alaric in making
an extravagant demand upon Ravenna, the feeble-minded
Honorius was connecting himself with a new favourite,
who succeeded in impressing the mind of the emperor with
alarms of the treacherous intentions of Stilicho. Honorius
determined to visit the camp at Pavia; and soon after his
arrival at it, a pretext was formed for massacring all the
friends of Stilicho, who occupied disdained posts in the
army and state. Stilicho received intelligence of this mea-
sure at Bologna; and a council, which he summoned, ad-
sired him to march immediately, and revenge the deaths
of his friends. Whilst he was hesitating, a Gothic chief
rushed into his camp, killed his guard, and penetrated
into his tent, whence he had but just time enough to escape.
Flying to Ravenna, he took sanctuary in a Christian
church; but being deceived by count Heraclien, who
appeared at the gates with a body of troops, and confiding
in his oath that he meant only to secure him, surrendered
himself into their hands. Upon this the treacherous count
produced an order for his immediate execution, to which
he was submitted with a firmness becoming the military charac-
ter which he had acquired. His son Eucherius was taken, after
apprehended, and put to death; and his daughter Thermi-
antia, who had succeeded her father in the imperial bed,
was divorced. Stilicho's surviving friends were cruelly tort-
ured, in order to procure the confession of a supposed con-
spiracy against the emperor; but they suffered in silence.
This catastrophe occurred in the year 408. The apparent
piety of Olympius, the new favourite of Honorius, has in-
duced the ecclesiastical historians to treat the memory of
Stilicho with great severity; but Zosimus, though upon
the whole not favourable to him, acquits him of the treason
laid to his charge; and the poetry of Claudian eulogizes
Hist.

STILL, the name of an apparatus used in distillation.
See Distillation and Laboratory. See also Alwm,
Etort, Worm, &c.

Dr. Lewis has contrived a still, adapted to his portable
furnaces, which is sufficient for the purposes of an experi-
mental laboratory. The body of the still is a wide copper
pan; and, for distillation in a water-bath, another veiled
of the samefigure is received into it almost to the top of
the space between them being nearly filled with water. Both
these vessels are of the same width at the mouth, and either
may be used as a still equally with the other: either of them
serves also, on other occasions, as an evaporating pan, a
boiler for experiments in dyeing, and other like purpo-
ses.

All the parts are made of thin copper plate, and well
tinned on the inside with pure tin. In consequence of their
thinness,
thinness, they admit of some alteration of their figure about the edges, so that though they should not be perfectly round, they are readily accommodated to one another, and fit cloze; the junction is easily made perfectly tight, by applying ordinary melt, and if required, the refined bladder, which are more convenient than luting, as being readily stripped off when the operation is finished. A short pewter pipe, with a pewter stopper fitted to it, for returning the distilled liquor, or pouring fresh liquor occasionally into the still, without the trouble of unluting and separating the vejiets, is folded into the top of the head, which, in these kinds of instruments, is the most convenient place for it. For separating, by distillation, spirituous from watery liquors, or the rectification of spirit of wine, the head is raised, by inferring between it and the breast, a thin copper pipe about two feet long. A warm and refrigeratory are necessary, as for the common still; and a glas head is requisite for some uxes, particularly for the distillation of vinegar, and such other liquors as would corrode a copper one, and impregnate themselves with the metal; in which case, the uxe of the metallic worn allo is to be avoided, and the glas or rose-ware receiver joined to the pipe of the head. Lewis’s Com. of Arts, p. 9, 10.

Still-Bottoms, in the Distillery, a name given by the traders to what remains in the still, after the working of the waff into low wines.

These bottoms are procured in the greatest quantity from the malt waff, and are of so much value to the distiller in the fattening of hogs, &c. that he often finds them one of the most valuable articles of the distillery. They might also be put to other uxes, such as the affording of a large proportion of an acid spirit, an oil, a fuel, and a fixed salt; and with some address, and good management, a vinegar and a tartar. Another very advantageous use of them, is the adding of them to the next brewing of the malt for more spirit: the increas of the produce from this is more than could easily be conceived. It also more readily dipoles the new waff to ferment, and gives the spirit a visosity that it cannot have without it; the proportion, in this case, can never exceed that of a fifth or sixth part of the whole quantity of the liquor employed. The liquor left behind in the still, after the rectifying of the low wines into proof-spirit, is also called by some by the name of still-bottoms; but this is little more than mere phlegm, or water impregnated with a few acid, and some oily parts, not worth separating, unless for curiosity. The liquor left in the still, after the rectifying of the proof-spirit into alcohol, is also of the same kind.

The bottoms of molasses spirits seem calculated for many uxes. It is very probable that the vinegar-makers would find their account in trying them, and the strong and lasting yellow colour with which they tinge the hands may recommend them to the dyers. A small proportion of them, added to the new treacle to be fermented, greatly promotes the operation, and increases the quantity of spirit.

The bottoms of the wine spirit, that is, the remainder after distilling the spirituous part from damaged wines, or wine-kegs, may be brought to afford Mr. Boyle’s acid spirit of wine, and that substance, called by Becher the medus fuscans vinii. A parcel of tartar may also be procured in very great perfection; and the lait remainder may be converted into excellent and genuine salt of tartar. The liquor may otherwise be serviceable in making vinegar and white lead. Shille’s Essay on Distillery.

Still-House. The Dutch have much the advantage of us in the structure of their still-houses, and have every thing in great readiness and neatness. The general rules in building these houses should be these:

The first caution is to lay the floor a slop, not flat, where any wet work is to be performed; it should also be well flagged with broad stones, so that no wet be detained in the crevices, but all may run off, and be let out at the drains made at the bottom and sides.

The stills should be placed abreast on that side of the still-house to which the floor has its current. The largest stills in Holland, for their greatest works, are never of that monstrous size which are constructed in England, but much more manageable and convenient, as seldom containing more than for or eight bogheads; and with such stills a single hand will perform more business than with one of a much larger size. Fronting the stills, and adjoining to the back wall, should be a stage for holding the fermenting backs, and these being placed at a proper height, may empty themselves, by means of a cock and a canal, into the stills, which are thus charged with very little trouble.

Near this set of fermenting backs should be placed a pump or two, that may readily supply them with water by means of a trunk or canal, leading to each back. Under the pavement adjoining to the stills should be a kind of cellar, wherein to lodge the receivers, each of which should be furnished with its pump, to raise the low wines into the still for rectification; and through this cellar the refined waff, or still-bottoms, should be discharged by means of a hose, or other contrivance. These are the principal things to be regarded in the erecting of a still-house for the original production of spirits; and if these rules are well observed, multifluid will be made with little more trouble than molasses; for by this means the bushes of brewing and cooling the waff, which, according to the method generally practised in England, takes up so much time and trouble, is entirely saved. Fermentation is carried on to a much greater advantage, and the quantity of spirit increased. Shaw’s Essay on Distillery.

Stillatious Oils, are such as are procured by distillation, in opposition to those got by infusion, expression, &c.


Stillingleet, Edward, in Biography, a learned prelate of the English church, was born at Cranbourn, in Dorsetshire, in the year 1635; and after preparatory education in the grammar-schools of Cranbourn and Ringdell, was elected in 1646, to be a fellow of St. John’s college, Cambridge. Of this college he was chosen fellow in 1653, and presented to the rectorcy of Sutton, in Bedforshire, in 1657, having previously received episcopal ordination from Dr. Browning, the deprived bishop of Exeter. In 1659 he published his ‘‘Irenicus, or the Divine Right of particular Forms of Church Government examined,’’ hoping, by this publication, to remove the prejudices, and consoliate the attachment of those who were alienated from the church of England. In this treatise he maintains, that Christ did not determine the form of the government of his church by any laws; that the church has adapted it to the various circumstances of time, place, and persons; that episcopacy is lawful; that in the primitive church no invariable form of church government was adopted; and that the most eminent divines, at the Reformation, did not conceive any one particular form to be necessary. In a new edition of this work, in 1662, he annexed an appendix, concerning the power of excommunication in a Christian church. The Irenicus was highly commended for its learning and moderation; but the author himself, as bishop Burnet says, deplores of avoiding the imputations of hostility to the church
which it occasioned, retracted the book, and gave way to the humours of a high fort of people, beyond what became him, perhaps beyond his own fene of things. Whilst he was employed in performing the functions of a country parson, he pretent to the public a second work, of exten-
vive learning and pertipicus style, which has been always esteemed one of the best defences of the Christian religion; and which was intitled "Origines Sacrae; or a rational Ac
count of the Christian Faith, as to the Truth and divine Au-
thority of the Scriptures, and the Matters therein con-
tained;" 4to. This work established his reputation as a
writer, so that he had a commination from Dr. Henchman, 
bishop of London, to draw up a vindication of archbishop
Laund's conference with Fisler the Jesuit; and the title of
his work was, "A rational Account of the Grounds of the
Protestant Religion;" 1664, folio, in which Dr. Tillotson
affords to be fully answerable to this appellation. Soon after,
he was elected preacher at the Rolls chapel, and in 1665
prevented by the earl of Southampton to the living of St.
Andrew's, Holborn, and appointed likewise lecturer at the
Temple. In 1668 he took his degree of doctor in divin-
ity, distinguiting himself on the occasion by keeping an
act in which he displayed great fluency in the Latin lan-
guage, and logical acuteness. At the nomination of
Charles II., to whom he was chaplain, he was nominated
archdeacon of St. Paul's, a work, which preferred him
above the archdeaconry of London, and in 1678 the
deanery of St. Paul's, which was his highest promotion
during that reign. Whilc Dr. Stillingfleet was thus ad-

dvancing from one dignity to another in the church, he was
occupied in a variety of compositions on doctrinal and con-
 tradorfer subjedec, more particularly directed against the So-
ciniens. He also published a number of tracts against the
Roman Catholics; one of the first was "A Discourse con-
cerning the Idolatry practised in the Church of Rome, and
the Hazard of Salvation in the Communion of it," 1671 ;
which provoked a great number of answers and replies.
Although much of his time must have been occupied in
controversial writings, he found leisure to present to the public
"A Letter of Resolution to a Person unsatisfied
about the Truth and Authority of the Scriptures;" which
was considered as an excellent piece of reasoning. He also
preached a sermon about the time of the Popish plot, the
design of which was to unite the Diffenters in the common
cause, and to induce them to abandon their separation from the
established church, which involved him in a contro-
versy with Baxter, Owen, and others, who were not likely to
acquiesce in his fundamental position; that, "since, ac-

cording to the judgment of divers among themselves, a con-
formity to our church's worship was not unlawful, by con-
sequence their separation must be sinful and dangerous." To
their strictures on his fermen he published a reply.

Dr. Stillingfleet extended his investigations far beyond the
limits of theological and ecclesiastical subjects; and on
occasion of the impeachment of the earl of Danby, he vindic-
tated the right of bishops to vote in criminal cases, in a trea-
tise entitled "The Jurisdiction of Bishops in capital Causes," which
proved his extensive acquaintance with parliamentary his-
tory, as well as statute and common law. A second work,
published in 1689, and entitled "Origines Britannice, or
the Antiquities of the British Churches," gave an ample view of
the origin and progress of Christian churches in Britain, since
the first introduction of Christianity in the island to the con-
version of the Saxons. In this research, Stillingfleet had
been preceded by the learned archbishop Usher, in his work
"De Ecclesiis Britannicarum Primordiis." King James
having instituted an ecclesiastical commission, summoned

STILLINGFLEET.

Stillingfleet, who had long been prolocutor of the Lower
House of Convocation, to appear before it; on which occa-
sion he drew up a "Discourse concerning the Illegality of
the Ecclesiastical Commission, in answer to the Indictment
and Defence of it," which was not published till the year
1689.

At the Revolution, the services rendered by Dr. Stilling-

fleeting the established church were recompensed by the
bishopric of Worcester, to which see he was consecrated in
October 1689; in which high station he was sedulous in the
discharge of the duties of his office, and in defending the
rights of his order by his speeches in parliament. On
the death of archbishop Tillotson, in 1664, the queen is said
to have wished for the advancement of Stillingfleet to the see
of Canterbury, but the Whigs opposed it, from an appreci-
ation "that both his notions and his temper were too
high." The bishop again engaged in controversial divinity
against the Socinians and Unitarians: and in a treatise in-
titled "A Vindication of the Trinity, with an Answer to
the late Objections against it from Scripture, Antiquity, and
Reason," he introduced some animadversions on Locke's
Essay on the Human Understanding, under an appre-
henion that the definition of subsistence, and the account
of ideas contained in that work, were unfavourable to the doc-
trine of the Trinity. The philosopher replied to the pre-

land, who is thought on this occasion to have sustained a defec-
An edition of his 50 sermons appeared in 1707,
folio.

Dr. Stillingfleet injured his constitution, which was natu-
rally strong, by his studious and fedentary life; so that repeated
attacks of the gout terminated his life on March 27th,
1699, after he had nearly completed his 64th year. He had
been twice married, and had several children, three of whom
survived him. His remains were interred in the cathedral of
Worcester, where a monument was erected to his mem-
ory, with a Latin inscription by his chaplain, the cele-
brated Dr. Bentley, in the high style of panegyric, part of
which has been thought to exceed even the just encomiums
to which this prelate was intitled. The bishop, who had a
good portion, and a lofty temper, somewhat moderated by
good sense and a knowledge of the world, had collected a
noble library, which was purchased, after his death, by
Dr. Marth, archbishop of Armagh, as the foundation of

STILLINGFLEET, BENJAMIN, grandson of the bishop of
the same name, and son of Edward Stillingfleet, M. D., who
left his father's favour by marriage, and afterwards taking
orders, settled upon a living in Norfolk. Benjamin was born
about the year 1702, and after a previous education at Nor-
wich school, was entered, in 1720, at Trinity college, Cam-
bridge, of which Dr. Bentley was then master; who, forgetting
his obligations to the family, procured the rejection of
young Stillingfleet, when candidate for a fellowship. We
may naturally imagine that the disappointed candidate should
feel resentment at such conduct, for which it is difficult to
devise a sufficient apology. The subject of our memoir
left college, and travelled to the continent; and upon his
return, passed an unambitious life, which was chiefly devoted
to the study of books and nature. Under the patronage
of lord Barrington, he obtained the post of barrack-maier
at Kennington. To Mr. Windham, of Felbrig, Norfolk,
he was more substantially indebted, being often refedent
at his house, and receiving from him an annuity, which
was considerably augmented when he became Mr. Wind-
ham's executor. He is well known as the author of several
pieces in prose and verse, particularly for "Everyday on
Conversation," which was published in the first volume of
Vol. XXXIV.

C'o

Doddley's
STILLINGFLEET.

Doddley’s Collection of Poems; and also from a volume of "Miscellaneous Tracts," printed in 1759, and containing chiefly of translations from Linnaeus’s Amphioxides Academicae. To this work were annexed valuable "Observations on Graecia," and also a "Calendar of Flora," formed upon a suggestion of the Swedish naturalist, and adapted to this climate. The poet Gray, with whom he became acquainted, mentions him in one of his letters, dated in 1761, in the following terms: "I have lately made an acquaintance with this philosopher, who lives in a garret in the winter, that he may support some near relations who depend upon him. He is always employed, consequently, according to my old maxim, always happy, always cheerful, and seems to me a worthy honest man. His present scheme is to fend some persons, properly qualified, to reside in Attica, to make themselves acquainted with the climate, productions, and natural history of the country, that we may understand Aristotle, Theophrastus, &c. who have been heathen Greek to us for so many ages." It is observed, that the term garret used by Gray is rather a disparagement of Stillingfleet’s town-lodgings at a stranger’s in Piccadilly, where he died in 1771, at the age of 60. He ordered all his papers to be destroyed at his decease. Gen. Biog.

This ingenious, learned, and worthy man, was well acquainted with the theory of music by reading and meditation; and with the practice by hearing all the best performers, and by frequenting their rambles and interchanges with Mr. Price of Foxley, Mr. Tate of Mitcham, and Mr. Smith, the disciple and successor of Handel in carrying on the oratorio, for whom Mr. Stillingfleet wrote new sacred dramas, which he set and had performed in turn with those of Handel.

His work, intitled "Principles and Power of Harmony," the most clear, agreeable, and interesting treatise on a dark, obscure, and speculative subject that we know, is nothing more than a commentary on the theoretical writings of the celebrated Tartini. It has been often observed with truth, that theory and practice are more frequently at strife in music than in any other art. Those who treat music merely as a science, without possefing the practical part, are naturally contracted in their ideas, and ufeles to professors: and, on the contrary, mere practical musicians, who have seldom had either education or leisuare to qualify themselves on the side of learning, produce nothing but crude and indigested reversion, which a man of taste in literature dildains to read. That this has been the case with some of the most able practical musicians, we can, from our own knowledge, assert. They have the ambition of puffing for men of science; they speak of Greek writers without Greek; of arithmetical proportions without figures; of ratios without geometry; and equations without algebra. The late Dr. Pepusch, a man of great learning, and of universal reading in musical compositions, attempted to explain the Greek systems; but abstruse calculations being necessary in the business, he had recourse to his friend De Motve, who was no musician, and understood the doctor as little as the doctor understood Euclid: they never met without a quarrel; for as each would talk abstruse and the other moderate, each must by turns have been abjured. The same thing happened in France between the famous Rameau and d’Alembert: at Padua, between Tartini and Padre Colombi, his friend, the professor of mathematics in that university. The work of which we are now speaking, however, seems free from such objections; as it was written by no half scholar or shallow musician; but by one possefl of all the requites for such a task.

In the author’s commentary on Tartini’s first chapter, he explains clearly the now well-known phenomenon of a single string or sound producing its own harmony, upon which Rameau has built his system of a fundamental base. (See BASS FUNDAMENTALS.) The author, in the history of this discovery, traces it no farther than the time of Mercurius, with whom he leaves it; but it seems to have been long known before his time, as the organ is constructed upon the same principle; the stops of that instrument being proportioned to each other in the same manner as the sounds above-mentioned, which are generated by a single string or tone: when the stops, known by the names of the diapason, principal, 12th, 15th, and tierce, are drawn out, every single key of an organ gives the complete chord, as, when G only is struck, and it is imagined that no other sounds are mixed with it, wind is conveyed to the pipes G, g, d, g, b, &c.

But the principal phenomenon upon which Tartini builds his system, was quite new, and discovered by himself. It is that of the third found produced in the medium by the concurrence of two sounds that can be sustained for any time upon one or two instruments, as trumpets, horns, flutes, hautbois, two violins, or one in double stops, two sounds on the organ, with only the open diapason out, &c. a third sound will be heard, which is its true fundamental base. See Terzo Suono, where thefe invisible bases will be specified to every interval, but chiefly those that are consonant. Every chord is characterized by this circle; its nature and signification in harmonies, Mr. Stillingfleet examines with great candour, and some pleasantry.

It is in the third chapter that Tartini unfolds his musical system, and treats of concords and dissonances, their nature and definition. The commentator’s remarks on this chapter are very solid and luminous.

The fourth chapter of Tartini gives the origin of the musical scale and genera, their use and consequences. In our author’s commentary upon this important chapter, he acquaints himself with great dexterity, and proves that he is not only profound in the theory of sounds, but endowed with nice feelings, and of great experience and observation, with respect to practical music.

But though we admire the ingenuity of Tartini in tracing the origin of the octave in modern music, and think, with his commentator, that it is not implanted in our nature, as it is never sung by any people out of Europe (nor would it seem so easy and natural there, if it were not for the bells and church singing in almost every Christian town and village, which indefinably teach intervals and the scale to every one that has a voice and an ear from early childhood); we regard the gamut, and its octaves and scales, as the musical alphabet; and nature never teaches an alphabet to the natives of the most civilized and polished country any more than to savages.

Our author’s praise of the harp, and wishes that there were better music for it than old and vulgar Welsh tunes, would have been highly gratified, had he lived a few years longer; for in 1771, when his book was published, a short time before his decease, the pedal harp had not been introduced or heard of in England. And it seems as if Madame Crumblitz was not only the first great performer upon that instrument in our country, but the first who had good music to perform, to shew its powers; with which she had been furnished by her husband and master.

The commentator joins with Tartini in thinking more favourably of the ancient Greek music and modes than late writers have done; and concerning Italian recitative, he gives from Tartini a curious account of its surprising effects, with no other accomplishment than a base.
In the year 1714, if I am not mistaken, in an opera performed at Ancona, there was, in the beginning of the third act, a passage of recitative, unaccompanied by any other instrument but the bafe; which raised, both in the profef{ion} and in the ref of the audience, such and fo great a commotion of mind, that we could not help staring at one another, on account of the visible change of colour that was caused in every one's countenance. The effect was not of the plaintive kind: I remember well that the words expressed indignation; but of fo harsh and chilling a nature, that the mind was disordered by it. Thirteen times this drama was performed, and the same effect always followed, and that too universally; of which the remarkable previous silence of the audience, to prepare themselves for the enjoyment of the effect, was an undoubted figure. This almost equals the miraculous powers related of the ancient Greek music. But this can never happen where the Italian language is not universally known to the whole audience.

A period of Tartini in favour of simple music, has suggested to his commentator a reflection which we cannot pass over in silence; as we are unable, implicitly, to subscribe to his opinion, that the tunes in the Beggar's Opera should be the standard of good melody, modulation, and harmony. It is true, that many of them are the tunes of our nurses, to which our ears have been accustomed from our infancy; for this reason, perhaps, ninety-nine out of a hundred of the playhouse, will prefer them to any other music. In fo mixed and popular an assembly as the audience of an English theatre, are not the majority ignorant of other music, and as likely to be prejudiced in favour of bad, as more refined ears in favour of a more polished and artificial kind of music; but would it not be the same thing with painting, poetry, and sculpture? Would not a sign-poll, highly coloured, be preferred by the ignorant to a picture of Raphael; or a jovial and balderdash song to the Essay on Man, or Milton's Paradise Lost? Simplicity almost equals the excellent and desirable thing in all the arts; but let it be an elegant simplicity, free from vulgarity and barbarism.

Why should people of refined ideas, and, if you will, delicate tastes, be governed by the ignorant and unpolished, any more than those last mentioned by the former? It has been well said, that authors and artists are the only people in this country who are not tried by their peers.

What Tartini says in favour of simplicity could never extend to such a medley of tunes of all nations being introduced into the Beggar's Opera, which are made up of Scotch, French, Italian, Irish, and English; and is a lover of music to be thought affectedly refined, who wishes for something less hackneyed and vulgar? The music in the pope's chapel, with which our author was so enchanted, could never remind him of that in the Beggar's Opera. But the moderns, and modern music, are always to be abused; it was in Plato's time; the custom has been continued by every writer on the subject; and every musician, who, like Timothens, adds a new firing to his lyre, will be found to endanger the flame; but about taste and prejudice, it has long been agreed, that there is no disputing; our habits and our feelings will ever be uppermost.

STILLINGIA, in Botany, was sent under that name to Linnaeus, by the celebrated Dr. Alexander Garden, of whom a biographical account may be found in its proper place. This genus is dedicated to Mr. Benjamin Stillingfleet, of whom we have made some mention in our account of Mr. William Hudson, and who is well known as the author of a popular book of "Tracts," relating to natural history, &c. partly translated from the writings of Linnaeus. He was an elegant scholar, an enthusiastic admirer of virtuous liberty, and a philosophical naturalist, intimately attached to the Price, Barrington, and Littleton families, as well as to some men of talents and cultivation in Norfolk. A M.S. volume of his advice to the late distinguished politician Mr. Windham, we have seen in the Felbrigg library.—(See the preceding article.)—Linn. Mant. 19. Schreb. Gen. 698. Willd. Sp. Pl. v. 4. 598. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 5. 537. Walt. Carol. 259. Pursh 609. Juss. 590.—Claris and order, Monocotyledones. Nat. Ord. Tricoce, Linn. Euphorbiae. Jull.

Gen. Ch. Male, Cal. Perianth leon-flowered, coriaceous, hemispherical; petal-shaped, entire. Cor. of one petal, tubular, funnel-shaped, gradually dilated upwards, much narrower than the calyx; its margin undivided, but fringed in a jagged manner. Stamina. Filaments two, thread-shaped, twice as long as the corolla, spreading at the summit, very slightly connected at the base; anthers kidney-shaped, of two round lobes.

Female, at the base of the same spike, Cal. Perianth as in the male, but single-flowered. Cor. superior, shaped as in the male. Ptil. German roundish, between the calyx and corolla; stigmas three, dilated, recurved. Peric. Capsule somewhat turbinated, bluntly triangular, three-lobed, of three cells, surrounded at the base by the enlarged calyx, sessile, oblong, obtusely triangular, marked on the inner side with a transverse scar.


Ob. The "two cup-shaped glands," which Schreber, after Walter, describes in the male flowers of the original species, appear to be either a bract, or abortive calyx. These perhaps contain some fruit.


3. S. fischeri. Poplar-leaved Stilligina, or Chineese Tall-tree. Michaux, ibid. Willd. n. 3. Pursh n. 3. Ait. n. 3. (Croton fischeri; Linn. Sp. Pl. 1434. Richius chinense fischeri, polupi nigree folio; Pati. Ger. Sp. 34 f. 5. Euonymus affinis Sinarum, polupi nigree folio, &c.; Pluk. Amath. t. 7. f. 500. f. 2.)—Stem arborescent. Leaves rhomboid, pointed, entire. Native of China, in moist situations. Now said to be naturalized on the sea-coast of South Carolina, flowering in July and August. It has been known more than a century in our florists, or rather greenhouses. The habit is that of a Poplar, with smooth leaves, on long slender flanks. Spikes terminal, dense, cylindrical. Male flowers with a roundish scale or gland at each side of the calyx, analogous to what we have mentioned after the Eff.
STILO, Ital. Style, in Mufa, a peculiar manner of fingering, playing, or composing. In ancient ecclesiastical music, the stiles of Palestrina, Tallis, and Bird, are venerable, and highly esteemed by masters, and all good judges of that species of composition. In oratorios, the stiles of Handel, Leo, and Jommelli, are marked with an original spirit of excellence; the opera stiles of Pergolesi, Halé, Piccini, Sacchini, and Paisiello; in symphonies, the elder Stamitz, the Manheim school, Haydn, Mozart, and Vanhal at the Vienna school, are original; as are the quartets of Haydn; the quintets of Boccherini and Mozart; the harpischord pieces of Domenico Scarlatti, Alberti, Schober; the piano forte pieces of Emanuel Bach, Haydn, and Mozart; but the comic operas of this last must be enrolled among the first for genius, originality, and good composition, that modern times have produced.

The town of Naples, in Calabria Ultra, 17 miles N.N.E. of Gerase. — Alto, a town of European Turkey, on the E. coast of Morea. N. lat. 36° 55′ E. long. 23° 4′.

STILBOTATUM, in Architectura, denotes the body of the pedestal of any column.

STILPO, in Biography, a Grecian philosopher, who was a native of Megara, flourished in the third and fourth centuries B.C., and is said to have died after the year 294 B.C. He is considered as belonging to the Megarian sect, and to have been a disciple of one of the successful of Euclid of Megara. In his youth he is represented as having been licentious; but having corrected his natural propensities by the moral precepts of philosophy, he acquired reputation among philosophers, and became distinguished for his sobriety and moderation; and also for his eloquence and skill in dialectics. When Ptolemy Soter captured Megara, he presented Stilpo with a large sum of money, and invited him to his court; but the philosopher returned the greater part of this money to the people of Megara, and chose to retire during Ptolemy's stay at Megara to the island of Egina. When Demetrius, son of Antigonus, took Megara, the folders were ordered to spare the house of Stilpo, and to return any thing that might have been precipitately taken from him. The philosopher being required to give an account of those effects which he had lost, replied, "that he had lost nothing; for no one could take from him his learning and eloquence." To the conqueror he recommended himself by the pathetic manner in which he incited upon him the exercise of humanity. So great indeed was his fame, that when he visited Athens, the people ran out of their shops to see him; and even the most eminent philosophers of Athens took pleasure in attending upon his discourses. Nevertheless, he excited prejudices by not paying respect to the Athenian superstitions, of which an infatuation or two occurred during his abode at Athens. Having asked a person, if Minerva, the daughter of Jove, was a deity? and being assured that she was, he rejoined, "but this before us (referring to the statue) is not the Minerva of Jove, but of Phidias, and therefore no deity." For this speech he was carried to the court of Areopagus, and ordered immediately to leave the city.
When Crates put the question to him, whether the gods took pleasure in prayers and adorations? experience having taught him caution, he replied, "you fool, do not question me on this subject in the public street, but when we are alone." But there is no proof of Stilpo's infidelity with respect to the existence of a supreme divinity. Some of his peculiar doctrines were, that species, or universal, have no real existence, and that one thing cannot be predicated, or affirmed, of another; and that in using the word "man" as an universal term, we speak of nothing; for the term signifies neither this man, nor that man, nor applies to any one man more than another. In order to prove that one thing cannot be predicated of another, he said, that "goodness" and "man," for instance, are different things, which cannot be confounded by asserting the one to be the other: he farther argued, that good-ness is an universal, and universal have no real existence; consequently, since nothing cannot be predicated of any thing, good-ness cannot be predicated of man. Some have supposed that Stilpo was not serious in this kind of reasoning, and that it was his intention merely to tetch the sophistry of the schools. If he be serious, it could not be wholly without reason that Glycera, a celebrated courtezan, when she was reproved by Stilpo as a corruptor of youth, retorted the charge upon him by saying, that he spent his time in filling their heads with sophistical quibbles and useless subtleties. On moral topics, Stilpo is said to have taught, that the highest felicity consists in a mind free from the dominion of passion, a doctrine similar to that of the Stoics. He lived to a great age, and is said to have hastened his final departure by a draught of wine. 

STILTON, in Geography, a village and parish in the hundred of Norman-Cros, and county of Huntingdon, England. The houses are situated on the sides of the high North road, in a flat country. The population of this place is 1800, and in the succeeding 11 years which occurred before the next report, it appears to have increased to 663 inhabitants and 107 houses. This village is chiefly noted for a peculiar species of cheese, which obtained the name of Stilton from having been first fold here; but it is manufactured mostly in certain districts out of Leicestershire. In a fortnight part of this cake is generally consumed, and is in a cheaper price. The usual retail charge is now 12. 6d. per pound. Each cheese is made of about 12 lbs. weight, and is formed in a deep round vat.

The great Roman road, called Ermine-street, intersected this parish from N. to S. between the two flations at Godmanchester, called Durobridge, and at Caistor, called Durolin-ponte. About one mile N. of Stilton is Norman-Cros, where very extensive barracks and a prison were erected during the late wars. The latter was appropriated to French prisoners, and several thousands were confined here at the time of ratifying peace.

South-west of Stilton, about one mile and a half, is Denton, the seat of the Cotton family, and the birth-place of the celebrated antiquary Sir Robert Cotton. (See Cotton.) This family, who retained large possessions in the north of Huntingdonshire, had formerly another estate, designated Connington, at a short distance south of Denton, and many of the descendents of the Cottons are buried in Connington church. Some fragments of the old manor are remaining. It is now the seat of the family of Heathcote. — Beauties of England and Wales, vol. vii. Huntingdonshire, by E. W. Brayley.
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kingdoms; among which may be enumerated all the aromatic plants, with their seeds, bark, and roots, the balsams, gums, and essental oils, procured from them; ammoniac, &c.

However these stimulant substancess may have contributed to the sensual gratifications of mankind, there cannot be a doubt that they, especially the various amnestic matters, have contributed quite as largely to their pains, difeases, and vices. The derangements of the functions, and ultimately of the structure, of some of the most important organs of the body, which continued or excessive stimilation induces, are well known, as well as the disorder of intellect, and the distortion of the moral principle, which so frequently refult from it. But upon these topics it were useless to enlarge. With respect to the medicinal employment of stimulants much might be said; for although the rational and observant part of the profession make a very sparing use of them in practice, they experience much difficulty in counteracting the mischiefs which popular and vulgar medical prejudices are constantly inflicting by cordials, and corrosives, and by the use of heating and irritating diet. There are few morbid conditions in which the constitution is benefitted by stimulants. In all difeases that are called nervouss, some organ or other is deranged in its structure or functions, most commonly the stomach, bowels, liver, or uterus; and he who attempts to remove the lowness and languor by stimulants, while the function or structure continues disturbed, will only make the patient worse. The Bustainable sytem, whose founder was practically too fond of the diffusible stimulants to fee clearly upon the subject, contributed to prolong the reign of stimulation in medicine, longer than unbiased reason and experience would have maintained it.

Gentle stimulants, employed with proper caution and regulation, are chiefly valuable under those circumstances of debility, which succeed fevers, hemorrhages, and other violent difeases, when the morbid action has ceased, and no organic disorder remains. The powers of the constitution often languish under such circumstances; the circulation is feeble, and the digestive functions weak; and the muscles, therefore, very slowly recruit their vigour and stimulat. Under such a condition of tardy convalescence, these functions are materially assisted by a supply of gentle stimulation; and it is then principally that stimulants are useful and safe.

STINCHER, in Geography, a river of Scotland, which runs into the sea at Ballantrae, in the county of Ayr.

STING, AEDULUS, an apparatus in the body of certain insects, in form of a little spear, serving them as a weapon of offence.

The sting of a bee, or wasp, is a curious piece of mechanism; it consists of a hollow tube, at the root of which is a bag full of sharp penetrating juice, which, in stingling, is injected into the flesh through the tube.

Within the tube, Dr. Derham has observed, there lie two small sharp bearded spears; in the sting of a wasp, he told eight beards on the side of each spear, somewhat like the beards of fish-hooks.

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One of these spears in the sting, or sheath, lies with its point a little before the other, to be ready, as should seem, to be first darted into the flesh, which once fixed, by means of its foremoat beard, the other then strives in too; and so they alternately pierce deeper and deeper, their beards taking more and more hold in the flesh: after which the sheath, or sting follows, to convey the poison into the wound, which, that it may pierce the better, is drawn into a point, with a small slit below that point, for the spears to come out at.

By means of these beards it is, that the animal is forced to leave its sting behind it, when disturbed, before it can have time to withdraw the spears into its scabbard. See Anatomy, &c. of Bees.

STING, or STITCH, a disagreeable smell exhalating from a corrupted or other body, and which is prejudicial to the nose and brain. A stinking breath is usually the result either of diseased lungs, or else of scorbative gums, &c.

A stinking nose, feter maris, is the result of a deep ulcer within the nose, whence arise fetid fæces, &c. Its cause, according to Galen, is a sharp putrid humour falling from the brain, on the processus mammillares. This is reckoned, by the civilians, one of the legal causes of annulling marriage.

STINK-HORN, in Botany. See PHALLUS.

STINK-POSS, an earthen swell charged with powder, and, other inflammable and suffocating materials, with a lighted fuse at the aperture, thrown on board an enemy's ship in the action of boarding.

STINKING HOUND, in Agriculture, a common weed in hedges and rubbishy places, of the more troublesome perennial kind. By the Swedes it is considered as an universal remedy in the diseases of cattle. See BALLOTA NIGRA.

STINKING-ILIS, a name sometimes provisionally applied to a disease of the brisky kind, often met with among sheep in some situations. See STOMACH-ILL.

STINKING ISLAND, in Geography, a cluster of islands near the E. coast of Newfoundland. N. lat. 40° 28'. W. long. 52° 30'.

STINOS, an island in the Grecian Archipelago, about six miles in circumference; 6 miles S. of Naxia. N. lat. 46° 52'. E. long. 25° 33'.

STINT, Tringa Cinclus of Linneus, in Ornithology, the name of a small bird common about the sea-floors in many counties of England, and seeming to be the same as the Cinclus Prior of Aldrovand, and the scianios, or junco of Bellonius, called by the French avocet de mer, the sea-lark; and by Pennant, purre.

It is somewhat smaller than the common lark, and in shape resembles the smaller rime. Its beak is black, slender, and straight; its legs of a dusky green, the toes being divided to their origin; the head and hind part of the neck are ash-coloured, marked with dusky lines; a white streak divides the bill and eyes; the chin white; under side of the neck mottled with brown; the back of a brownish ash-colour; the breast and belly white; the coverts of the wing and tail of dark brown, edged with light ash-colour or white; the greater coverts dusky, tinged with white; the upper part of the quill-feathers dusky, the lower white; the two middle feathers of the tail dusky, the rest of a pale ash-colour, edged with white.

These birds come in prodigious flocks to our coasts during the winter: in their flight they perform their evolutions with great regularity; appearing like a white or dusky cloud, as they turn their breasts or backs towards you.
you. They leave our flowers in spring, and retire to some unknown place to breed. They were formerly a well-known dish at our tables, under the name of flints.

Pennant.

STINTER, in Geography, a river of Switzerland, which runs into the Thur, near Bifchoff-Zell.

STTO, a town of Naples, in Principato Citra; 16 miles S.W. of Cangiano.

STIP, in Ichthyology, a name given by the Dutch in the East Indies to a fish of the class of our European ones which has a two-back-fins, the anterior of which is prickly, the hinder not so. Its face is spotted, and its fish very delicate, and well tafted. It is generally caught by hooks.

Ray.


Gen. Ch. Cal. Glume single-flowered, of two valves, pointed valves. Cor. of two valves; the outermost terminated at the tip by a very long, twisted, erect awn, pointed at the base; inner valve long the outer, awnless, linear. Nectary of two linear-lanceolate, membranous scales, gibbous at their base. Stam. Filaments three, capillary; anthers linear. Pila. Germen oblong; styles two, hairy, united at the base; stigmas two, linear, linear. Peric. none, except the glume adhering to the seed. Seta solitary, oblong, covered by the corolla.

Obl. Linnaeus remarks that the genus is distinguished by the awn of the corolla being connected by a joint to the extremity of the glume.

Eff. Ch. Calyx of two valves, single-flowered. Outer valve of the corolla terminated by a very long awn, pointed at the base.

1. S. penna. Soft Feather-grasses. Linn. Sp. Pl. 115. Engl. Bot. t. 1356. Knapp. t. 38. —Awns feathered. Native of many parts of Europe, and admitted into the British Flora on the authority of Dillenius, to whom specimens were sent from Wettmoreland, said to be gathered on lime–stone rocks. The plant has, however, never been detected since in this country. It flowers in June. Root perennial, fibrous, tufted. Stems a foot high, leafy, smooth, fimbriated, jointed. Leaves upright, long, slender, acute, rough-his, their sheaths very long, dilated, embracing the stem, fimbriated, smooth, shining on the upper side. Stipa lanceolate, adhering to the leaf. Flowers in a simple panicle, rising from the sheath. The valve of the corolla, being very sharp and barbed, works its way into the ground, and the awn then separates from it by means of the brittle joint.

"In curious gardens this elegant plant is cultivated for the sake of its plump awns, which are sometimes worn by ladies as feathers, or used to decorate the chimney-piece in winter, the air of a room keeping them in continual motion."


STIPA.

branched, spreading *panicle*. **Corolla** rough at the top. *Cavanilles* rightly determined the plant of Vahl.

10. **S. ovata**. Oat-Feather-gras. Linn. Sp. Pl. 116. (Andropogon folio superiori fpathaceo; Gron. Virg. 153.)—Awns naked. Calyx equal to the seed in length.—Native of Virginia. **Stems** slender. Upper leaf ventricose, the length of the **panicle**, which is composed of conjunctive, single-flowered *flasks*. **Leaves** frayed, smooth. This **grass** resembles *Avena fatua* in habit, but is smaller.

11. **S. membranacea**. Membranaceous Feather-gras. Linn. Sp. Pl. 116. Wildl. n. 11.—Flower-flasks dilated, membranaceous.—Native of Spain. This species is also like an *Avena* in habit, and is scarcely a foot in height. **Stem** smooth, thread-like. **Panicles** simple, scarcely subdivided, loose, feathery. **Flowerv-flasks** convoluted, bluish. **Awns** of the calyx the length of the **glume** of the corolla. **Linnaeus** in his *Mannta* calls the *panicle* a racemus, and observes that the upper flower but one is sessile. This is mentioned in Fl. Brit. 119, as certainly a *Festuca*, very near to *uniglumis*, if not the very same.

12. **S. barbata**. Bearded Feather-gras. Mart. n. 12. Desfont. Atlant. t. 27.—Leaves rigid, frayed on one side. **Panicle** lax, elongated. Awns very long, bearded from the base to the tip.—Native of uncultivated hills in Barbary. Very like *S. ovata*, but differs in having rigid, glaucous, flatish leaves, frayed on one side, wider, tereated, with a very long awn, hairy all over.


15. **S. canadensis**. Canadian Feather-gras. Lamarck n. 12. Pursh n. 2. (S. juncea; Michaux Boreal-Amer. v. 1. 1803.)—Leaves thread-shaped, very long. **Panicle** spreading. Calyx one-third the length of the corolla. **Awns** straight, naked.—In sandy fields, from New Jersey to Carolina, flowering from June to August. The silky purple *panicles* exceed in beauty every other **grass**. Pursh.

17. **S. exsativa**. Spreading-flowered Feather-gras. Lamarck n. 18. Pursh n. 6.—Leaves frayed, smooth, rather glaucous. Spikes alternate, panicled, spreading. Flowers distantly, sessile. **Calyx** longer than the corolla. **Awn** very short, naked.—Found in Carolina, by M. Bofc. **Panicle** lax, eight or ten inches long, of whole very long capillary branches supports a slender spike of alternate very small flowers.

18. **S. panicoides**. Panic Feather-gras. Lamarck n. 19.—Leaves leaticose, smooth. **Panicle** contracted, of few flowers. **Awn** naked, thrice as long as the calyx. **Seeds** lenticular.—Gathered by Commerson at Monte Video. This has rather the habit of a *Panicum*, with straight, smooth **leaves**, and long very slender **flanks**.

19. **S. fria**. Clove-branched Feather-gras. Lamarck n. 20. Pursh n. 17.—Leaves lanceolate. **Panicle** elongated, with jointed very close branches. **Awn** naked, somewhat zigzag.—Gathered in Carolina, by the late Mr. Frazer. A tall plant, with reed-like **leaves**, and the **inflorescence** of an *Andropogon*.* Purpure.*

20. **S. mollis**. Downy-flowered Feather-gras. Brown n. 1.—Leaves involute, with downy sheaths. **Corolla** finely. **Awn** feathery from the base, beyond the joint; naked at the end.—Found by Mr. Brown near Port Jackson, New South Wales.

21. **S. sumbharbata**. Half-bearded Feather-gras. Br. n. 2.—**Awn** feathery from the base to the joint; naked beyond. **Corolla** finely. **Calyx** coloured, roughish.—Native of Van Diemen’s land.

22. **S. pubescens**. Downy-jointed Feather-gras. Br. n. 3.—Leaves involute, with a short stipula. Joints of the **stem** downy. **Awn** very finely downy below its joint. **Corolla** finely. **Calyx** abrupt, somewhat jagged.—Gathered near Port Jackson, by Mr. Brown.

23. **S. ferruginea**. Joints-feathered Feather-gras. Br. n. 4.—Leaves involute, smooth like their sheaths. **Stipula** elongated, undivided, naked. Joints of the **stem** smooth. **Panicle** lax. **Awn** naked, bent. **Corolla** downy. **Calyx** smooth, with long tapering points.—Native of New South Wales, and Van Diemen’s land. **Brown**.

24. **S. elegans**. Elegant Feather-gras. Labill. Nov. Holl. v. 1. 23. t. 29. Br. n. 5.—**Awn** naked. Branches of the **panicle** compound, feathery.—Gathered by Labillardiere at Cape Van Diemen. A yard or more in height, branched, with a solid, rather woody, **stem**. **Leaves** involute, with tumid sheaths. **Panicle** ample, rather spreading; its branches slender, once or twice forked, finely feathery throughout. **Calyx** longer than the **corolla**, downy. **Awn** long, tapering, smooth; spiral at the bottom.


26. **S. arvensis**. Joints-feathered Feather-gras. Br. n. 7.—**Stem** compressed, smooth and even like the sheaths. **Leaves** involute. **Stipula** elongated, naked, somewhat notched. **Awn** naked, very long, nearly straight. **Corolla** finely.—Gathered by Mr. Menzies, on the south-west coast of New Holland.

27. **S. micrantha**. Minute-flowered Feather-gras. Br. n. 8. Cavan. Bev. v. 5. 42. t. 457. f. 2?—**Stem** branched, smooth as well as the sheaths. **Leaves** nearly flat, rough. **Awn** naked. **Corolla** smooth, nearly feathery. **Calyx** pointed.—**Gathered near Port Jackson, by Mr. Brown**, who has some doubt respecting *Cavanilles*’ synonym. The latter describes his as a New Holland plant likewise, flowering in April. The **stem** is slender, a foot and half high, erect, with three or four reddish-brown joints. **Leaves** rather short, with long sheaths. **Panicle** four inches long, dense, with short branches like a spike. **Flowers** very small, smooth, each with a bent **awn**, not an inch in length.

28. **S. eminens**. Tall Feather-gras. Cavan. Bev. v. 5. 42. t. 457. f. 1.—Lamarck n. 27.—**Stem** and sheaths very smooth, frayed. **Leaves** flat. **Awn** naked. **Corolla** downy.
downy, Calyx pointed.—Native of Mexico, near the town of Chalma, flowering in August. The stem, three feet or more in height, is nearly covered by the long sheaths of the still longer leaves. Panicule lax, compound, a foot in length. Outer valve of the corolla very downy all over. Awn an inch and half long, bent towards the middle.

29. S. humilis. Dwarf Feather-gras. Cav. 1c. v. 5. 41. t. 466. f. 1. Lamarck n. 3.—Leaves convolute; the floral one with an inflated sheath, and taller than the panicule. Awn naked at the base; feathery below the joint.—Native of South America, near Port Delire, in a barren soil, flowering in December. Stems several, from four to six inches high, slender, smooth, hairless. Lower leaves slender, involute, awl-shaped; the upper one with a long swelling sheath, embracing the panicule, which does not rise so high as the leaf itself, and is scarcely branched, consisting of but eight or nine flowers, on short smooth stalks. Calyx whitish, very acute, more than thrice as long as the corolla. Awn with a series of long white feathery hairs, below its joint.

30. S. ukranensis. Tartarian Feather-grass. Lamarck n. 22. III. Gen. v. 1. 157.—"Tifia; Gueudard. Mem. v. 1. t. 19. c. 1. 23."—Leaves channelled, keeled. Awn naked at the base, very acute, more than thrice as long as the corolla. Native of the Ukraine. The radical leaves are copious, forming dense tufts. Stem two feet high. Panicule eight inches long, a little drooping, with almost setaceous branches. Calyx reddish, with pale papery points. Corolla downy at the base, with a straight, naked, capillary awn, four or five inches long. Horsetails are said to be very fond of the feeds.

STIPEL, in Geography, a town of Prussia, in Oberland; 9 miles N.N.W. of Soldan.—Alfo, a town of Germany, in the county of Mark; 3 miles S. of Bockum.

STIPEND, Stipendium, among the Romans, signified the name with tribute; and hence stipendarii were the name with tributarii.

STIPES, in Botany and Vegetable Physiology, an old Latin word for a flake, or the trunk of a tree, is technically used for the flake of a FROND; see that article. Thus the flake of a fern is a true Stipes. The same term is also used in fungi, for the flake of an agamic, &c.; but never for any thing except cryptogamous plants.

STIPES, Stipite, Stipitum. See NATIVI.

STIPPING, in engraving on copper by means of dots; and is contradistinct from this word flippeting, from that mode of art which consists of courses of continued lines. The dots in flipped engravings are either round, that is to say, each dot forms a small cone in the copper, whose apex is downward; or they are angular, each dot forming a peak, or small isosceles triangle, on the surface of the plate; or, when the dot conists of more than one of these peaks, (as is commonly the case in engraving in the chalk manner,) its form is of course multangular.

The round dots in flippeting are performed by means of a dry needle, or an etching-point; and the angular dots by means of that well-known steel instrument which is termed a graver. Stippeting with the graver is also much used in the art of engraving on wood.

It has happened unfortunately for the public and for this branch of engraving, that some thirty or forty years ago, while it was imperfectly known and practised, it was much sought after by the English traders in art, on account of its cheapness, and the novelty which then rendered it attractive; and that now,—so fickle is taste or fashion, and such its unhappy influence on art; so crafty are the majority of dealers, and so heedless the majority of the public;—now

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chall-engraving is improved, it is neglected. In the hands of the elder Schiavonetti, Cardon and Holl, it acquired a variety, a rich and harmonious copiousness, and an energy it had not before disdained; of which "The Landing of General Abercrombie's Army in Egypt," after De Loutherbourg, and "The Woman taken in Adultery," after Rubens, are feliciteous examples.

In the former of these, the water, lily, smoke, broken ground, and other passages of the landscape part of the performance (which had hitherto opposed so many difficulties to the progress of chalk-engraving), are scarcely less happily discriminated than they would probably have been, had Schiavonetti employed the line-engraver's art, in which he was so great a proficient: but it is observable, that the clearness of the water, the crumbliness of the ground, &c. are in a great degree owing to the flipping being wrought into lines, such as are usually hatched in drawing with chalks.

The best line-engravers have always, from the very infancy of the art, intermingled with their work a large portion of flipping. The works of the celebrated portrait engravers of France more especially abound with it. And the best line-engravers have either mixed positive lines with their flipped work, or wrought their flipping into courses of chalky lines, and disdained the work above-mentioned by Schiavonetti, and in the draperies of Cardon's print of "The Woman taken in Adultery."

In our account of the ENGLISH School of Engraving, we have asserted that the modern improvements in chalk-engraving have been effected chiefly by living professors; but Schiavonetti and Cardon are now no more.

STIPPING is a term also used by miniature painters, to express the minute touches of colour laid on with the points of hair-pencils, with which their works on ivory for the most part consist, and which give that mottled or granulated surface to miniature pictures which is more or less obvious, and in which the granulation is larger or smaller in the different works of this species; serving to discriminate the style of execution of one artist from that of another.

STIPULA, in Botany and Vegetable Physiology, an ancient Latin word for a flower, as well as for the flowers remaining upon straw or reeds. Linnæus has adopted it for those appendages to the herbage of plants, which are so many inflorescences, though not presint in all. See fulcra.

STIPULATION, in the civil Law, the act of stipulating, that is, of treating, and concluding terms and conditions to be inferred in a contract.

Stipulations were ancienly performed at Rome with abundance of ceremonies, the form of which was that, one party should interrogate, and the other answer, to give his content, and oblige himself.

By the ancient Roman law, nobody could stipulate but for himself; but as the tabellones were public servants, they were allowed to stipulate for their masters; and the notaries, succeeding the tabellones, have inherited the same privilege. The stipulation had its origin in the lex Aquilia, and another law of the emperor Augustus. See Satisdictio.

The word is formed from the Latin stipula, a straw, because in making a faic, a straw was given to the purchaser, in sign of a real delivery; which custom is still retained in some parts of France, particularly at Verdun. The custom always has been on this occasion, for the two parties to break a straw between them, and each take his moiety, which they afterwards joined again, to recognize their promise.

STIPULICIDA, in Botany, from stipulae, the appendix.
ages of the leaves, and cedo, to cut, because the stipulae are divided into many fine segments, a supposed genus of Michaux, Fl. Boreal.-Amer. v. 1, t. 26. t. 6, of which he there describes and delineates one species, S. fetacea. This is Polycarpum stipulifidum. Pursh 90, after Peron. It occurs in barren gravelly soil of Lower Carolina, flowering in May and June. The root is annual. Stem erect, very slender, a foot high, repeatedly subdivided in a foxtail manner, with a pair of small feather stipulae under each joint. Leaves all radical, small, ovate, ifalked. Flowers minute, three or five together in each little terminal tuft.

STIRI, in Geography, a town of European Turkey, in the province of Livadia; 9 miles south of Livadia.

STIRIA, in Ancient Geography, a small island near the isle of Cyprus, on the northern coast, towards the west, in a small gulf, between the promontory of Acadus to the N.W. and the town of Atnaonoe to the S.E.

STIRIA, or STIRIA, in Geography, a duchy in the empire of Austria, bounded on the north by the archduchy of Austria, on the east by Hungary, on the south by Carniola, and on the west by Carinthia. It is divided into Upper and Lower. Upper Stiria is bounded on the north by Austria, on the east by Hungary, on the south by Lower Stiria and Carinthia, and on the west by the archbishopric of Salzburg; and is about 110 miles in length from east to west, and from 25 to 45 in breadth from north to south. Lower Stiria is bounded on the north by Upper Stiria, on the east by Hungary and Croatia, on the south by Carniola, and on the west by Carinthia; its extent from north to south is about 80 miles, and about 48 from east to west. Upper Stiria contains many lofty mountains, but, by the industry of the inhabitants, the whole country is pretty well cultivated; inasmuch that, in many places, the very highest tops of the mountains are inhabited. The people who dwell in these parts in winter, when large quantities of snow fall, are for several months kept as it were prisoners; and even in general seldom come down from their heights. By continual colds too they are habituated to the cold. It is very astonishing, that amidst these mountains and steep heights they are able to succeed with the plough, and that the eminences themselves are likewise fertile. They cultivate a fine sort of wheat, which is sufficient not only for the supply of their own necessaries, but in some measure also for sale. They have, in particular, large breeds of cattle, wild fowl, game, and chamois: the brooks and lakes, of which there are many situated between the high rocks, are rich in fish. In some places too are small vales; and the inhabitants endeavour to avail themselves of every spot of earth. The mountains contain silver, lead, copper, and, in particular, iron. The iron-mines have been already worked above one thousand years, and still continue rich. The Stirian steel is highly valued. The forests with which the ridges of the mountains here are covered, yield in sufficient quantity the wood necessary for the smelting-huts. Silver was formerly dug; but ever since the year 1588, the mines have been filled with water. In the mountains, likewise, are hot-baths and medicinal springs. At Aussee are some good salt-works. The principal rivers which run through this country are the Muehr and Ena. Judenburg is the capital. Lower Stiria contains fewer mountains, and more champaign: the soil is generally fertile, and on the hills is produced some good wine. In it are hot-baths and medicinal springs. This part of the country is watered not only by the Muehr, but also by the Drave and Save. Grat is the capital. In the whole duchy are nearly 120 towns, and 500 citadels: many of the last stand on the highest summits of the rocks. The highways are good, notwithstanding the country is mountainous. The language is very rough. The inhabitants of the quarter of Cilley are Winds or Wends, and speak the Wendish language, which is in use even among the common people, for some miles from Grat. Those who are but a small degree removed from the common rank speak Wendish, German, and Italian, and the principal inhabitants also French. No other doctrine, or worship, was till lately permitted in all this country, excepting that of the Roman Catholic. At Seckau is a bishop, who bears the title of a prince of the holy Roman empire; he is subject to the archbishop of Salzburg, whose general vicar he also is through the greatest part of Stiria. The most important manufactures in the country are the iron and steel works, the produce of which is exported in great quantities. Stiria was formerly a part of Carinthia, but in the eleventh century was separated from it, and made a peculiar mark. The number of inhabitants, as stated by M. Marcel-de-Serres, (Voyage en Autriche, &c. published at Paris in 1814,) was 800,000.

STIRIS, in Ancient Geography, a town of the Phocide, situated in the environs of the frontiers of Boeotia. Here was a temple dedicated to Ceres Stiritis: the statue of the goddess was of fine marble, holding a flame in each hand. Ceres was highly honoured in this place. Pausanias.

STIRK, or STUK, a term used among country people for a young ox or heifer.

STIRLING, formerly Stirling, in Geography, an ancient town, and capital of the county of Stirling, Scotland, is noted, in the annals of Scottish history and topography, for many important events connected with its castle, and for the peculiar situation of that and its other buildings. Like the castle of Edinburgh, that of Stirling is erected on the summit of a craggy precipice; and the town is built and disposed along the ridge of a hill, which slopes to the north and south, and is very abruptly terminated at the west. The origin of this fortress is not recorded, but it is evidently of remote date. Border wars generally occupied its inhabitants till the accession of the Stuart family to the throne of Scotland; whence the ancient name of Strirling arose, it is thought, from the frequency of strifes in its vicinity. The ready communications between the northern and southern parts of Scotland, by means of the bridges and fords in this neighbourhood, rendered the possession of Stirling castle always an object of great importance. From its hill may be viewed two of the most celebrated scenes of Scottish triumph, the fields of Falkirk and of Bannockburn.

The history with respect to the incorporation of the town is wholly unknown: the earliest charter which is extant bears the name of Alexander I.; but as this only confers some additional privileges, it is supposed that the town existed at a much earlier period. About the middle of the twelfth century, Stirling was honoured as a royal residence, for David I. kept his court here, to be near the abbey of Cambuskenneth, which he founded in 1147. Some marks of regal magnificence yet remain about the castle.

James III. afterwards raised Stirling higher into notice, by making it the principal place of his habitation. He adorned it with a magnificent hall for parliamentary meetings, of which the walls alone remain. Pope Alexander VI. when it became a kingly residence, added a royal chapel adjoining the former building. Within the towers of Stirling, several of the Scottish monarchs were either born, or underwent the ceremonials of coronation; and it became a place of retirement for the unhappy Mary, and for the minority of James VI. under his tutor Buchanan. In the north-west part of this edifice, James II., about the middle of the
15th century, shuttered William, earl of Douglas; and the cloist is still designated by the name of the Douglas room.

Near the castle is a flat piece of inclosed ground, once appropriated for tournaments, and a rock, whence the female spectators used to behold the valour of the knightly champions, now called "The Ladies Rock." On the south side of this fortress, surrounded by a stone wall, is the park; at the east end of which, vestiges of the royal garden, and a mount of earth, the frequent scene of the amusements of James IV, are yet visible. This park, with several other neighbouring pieces of land, form the custumary of the castle.

Since the reign of queen Anne, when this building was enlarged, and a battery erected, and called by her name, no material alterations have taken place: it is now commonly commanded by the usual routine of military officers, and garrisoned by 100 men.

The houses and public buildings which constitute the town are chiefly of an ancient style; particularly that begun by the earl of Marr, when regent of Scotland, in 1570, yet unfinished, and entitled Marr's work; and one known by the name of Grey's lodging, some time possessed by that family, but originally erected by Alexander, vicount of Stirling. Two churches, denominated from their situations the east and west kirks, have also a claim to antiquity: they constituted, it is supposed, at the period in which they were built, but one edifice, and were connected with the monastery of the Franciscans. They are thought to have been erected by James IV. in 1494; and from the circumstance of the eastern end having received some additions from cardinal Beaton, is the reign of Mary, they are sometimes described as having been built by different founders, and at different times. At the reformation, a partition wall was added, which now forms them into two extensive and convenient churches. James VI. was crowned here in 1567, and general Monk raiied his batteries in this church-yard in 1651, when the castle was besieged. The flece and roof yet retain the marks of having been violently battered by the shot from the garrison.

The town-house is a large building, with apartments for the town and county courts: in the council chamber is kept the heraldic records of the county. Stirling contains three hospitals, six, one, endowed by Robert Spittal in 1530, for poor tradesmen; a second, founded by John Spittal in 1659, for decayed brethren of the guild; and a third, instituted by John Allen in 1725, for the education and maintenance of the children of poor tradesmen. Beside these charitable institutions, the merchant company, the kirk fellowship, the kirk fellowship of theburgh feecers, the town funds, and those of each particular incorporation, in addition to large voluntary contributions, are all employed to relieve the wants of the poorer inhabitants.

In this town is the only prison in the county. Here are a weekly market on Friday, and six annual fairs. The population of Stirling, till the manufactures caused the erection of many new buildings, has undergone but very little alteration for the last 600 years; but of late, as the comparative reports of 1800 and 1811 prove, it has considerably increased: in the former year it amounted to 5271 inhabitants, with 620 houses; and at the latter period, to 8280 inhabitants, and 749 houses. The manufactures which are carried on here are those of carpets and cotton, which have been introduced from Glasgow: formerly, sloaons were made in Stirling to a considerable extent; but though in some degree still carried on, the manufacture has greatly declined from its first commercial greatness. There is a valuable salmon fishery on the Forth, which forms a part of the corporate revenue. (See Forth.) In this borough, the municipal government is vested in a provost, four bailies, a deacon guild, a treasurers, seven merchant-counsellors, and seven deacons of trade; it has also the privilege, in conjunction with some other places, of returning one member to parliament.

To the north-east of Stirling, a small village, called the abbey, marks places where that of Cambellkenneth formerly stood. The abbots of this place was originally denominated abbots of Stirling. This was founded, as already noticed, by David I. in 1147, and supplied with inhabitants from Arosie, near Arbroath, in Scotland. For about 200 years after its erection, it rapidly increased in ecclesiastical power and splendour. In the reign of David Bruce it was despoiled of its most costly furniture, and in consequence of this, the vicarage of Clackmannan was presented to it by the bishop of St. Andrews. In 1559 the monastery was again despoiled, and the reformed religion received by many of its former inmates. In the commotions attending the reformation, its benefices were seized, its revenues forcibly diverted of, and its very stones were carried by the earl of Marr for the construction of the building entitled Marr's work. The extent of the whole parish does not exceed 200 acres.


STIRLINGSHIRE, one of the counties of Scotland, situated nearly in the centre of the southern portion of that country, and occupying a narrow tract of land; bounded on the east and part of the north by the Frith of Forth, on the west by Loch Lomond, on the north-west by Perthshire, and on the south by Dunbartonshire. This area of land measures about 49 miles from east to west, and on an average nearly 16 miles from north to south. The boundary line is however very irregular, and is formed in a great measure by the natural demarcation of rivers and lakes: on its southern side was a famous Roman wall. From the peculiar natural features and situation of this district, it appears to have been a repeated scene of hostilities in former ages, when political jealousies and animosities impelled the Scots, Picts, Britons and Roman mercenaries of these islands, to wage continual wars with each other. Hence this country is particularly noted in the annals of Scotland.

The Romans erected one of their celebrated barriers on the edge of this district; and the most famous of the Scotch battles have taken place at Falkirk and Bannockburn, within this county. The lawless Highland chief, Rob-Roy, at one time held the lands along the eastern shore of Loch Lomond, and levied black mail, or money for protection, to the south-east of this district. Several of his caverns are yet remaining. The parish of Killearn is noted for the birthplace of the poet and historian, George Buchanan, Kilkenny for the greatest victory James, marquis of Montrose, gained in behalf of Charles I. The topographical antiquities of the county are, the northern front of the Roman wall; two large cairns, wherein human bones and funeral urns have been discovered: a singular Druidic monument of three large stones, denominated "the auld wife's lif;" and remains of early fortifications along the course of the Forth. The embalmed bodies of lady Kilflyth, with her Joan, may be also regarded as a singular though not a remote piece of antiquity, they having been preserved in a most surprizing manner after death, for many years. A rude circular building was formerly standing on the banks of the Carron, and entitled by the neighbouring inhabitants "Arthur's oven." It was supposed to have been a temple to the god Terminus, the protector of land-marks, erected by Agricola, when he fixed the boundaries of the Roman empire. The parish of Dunipace is also supposed to have derived its name from the two
two artificial mounts near the church, thought to have been reared at the conclusion of some important treaty. The remains of a religious house, founded by king Malcolm IV., about the year 1156, for nuns of the Bernardine order, called Emanuel nunnery, are situated on the west bank of the water of Avon.

Mountains.—The most hilly parts of this county are in the neighbourhood of loch Lomond to the north, and those of the southern division are in the parishes of Kilpatrick, Balderock, Campie, Killyfirth, and Denny. The northern ranges of the latter are denominated the Lennox hills. The more southern branches receive the names of the parishes in which they are, and are called Campie fells, Killyfirth or Kilpatrick hills.

The principal northern mountain is Ben Lomond, which rises from loch Lomond. (See Ben Lomond.) The highest in the southern division of those denominated the Campie fells, is about 1500 feet above the level of the sea; and nearly 1200 from the base of the ridge. Although the activity of the hills is generally very rapid, they possess more of the character of the Lowland than of the Highland mountains, for their surfaces are either verdant, or covered with mossy pasture, and they do not present terrific and precipitous naked peaks. In the parishes of Killyfirth, these mountains never exceed in their elevation 1000 feet from the valley, or 1508 from the level of the sea: the view from the highest of these is one of the most extensive, beautiful, and variegated in all Scotland, and commands nearly one half of that delightful kingdom, the prospect being suppos'd, at a moderate computation, to embrace an area of 15,000 square miles.

Mineralogy and Mineral Products.—The minerals of Stirlingshire consist chiefly of coal, iron-flints, and lime-flints. The vicinity of the Grampian hills appears to cut off all secondary strata to the north-west; and towards loch Lomond the country is destitute of any valuable mineral. Ben Lomond is composed of granite, interpenetrated with quartz, which is found near the top in such masses as to weigh several tons. The shores of the loch beneath are covered with rounded pebbles, composed of quartz, granite, and micaceous schistus, with coarse red jasper, similar to the composition of the adjoining hills, from which they have been washed by rivulets, and polished by the waves of the lake. Upon the Enrick, and the upper part of the Forth towards the centre of the county, peat is the ordinary fuel; but in Campie, Killyfirth, and towards the east, large strata of coal run within the bowels of the mountains. In various parts of the hills, passing from Dumbarton to Stirling, are subterraneous piles of basaltic rocks; and a grand colonnade of basaltic columns rises in a hill called Dun or Down, in the parish of Fintry. This consists of twenty pillars in front, of a gigantic stature, some appearing to be separated in loofe blocks, and the shafts of others seeming entire through the whole extent: they stand perpendicular to the horizon, and rise to the height of fifty feet. They consist of various shapes, being square, pentagonal, and hexagonal. On the eastern side of this range the pillars are parted by the distance of three or four inches. This gradually lefens towards the west side, till nothing more than a mark is to be deciphered, and which soon disappears in one solid mass of rock, very much honeycombed, and which has the appearance of having been ignited. The mountain on which they stand consists of extensive beds of red ochre. The frost of the precipitation in the parish of Strathblane, for the space of a fortnight, is laced with flatly columns of the same kind. They consist of four, five, and six files, from two to three feet in diameter, and thirty feet high. They rise from the horizon with a little inclination from the perpendicular, and some of them are apparently bent in the segment of a curved line. In the latter mentioned parish, at the water-fall called the Spout of Ballagan, a very remarkable section of the hill is presented. The side of it, being perpendicularly cut by the water, discloses two alternate strata of earth and limestone; but towards the bottom of the section are several thin strata of the purest alabaster. Near the same place, in a late inundation of the river, some fragments of antimony were thrown up, which on trial were found to be of the finest quality. The vein, however, from which they were torn, has not been discovered. In what are filled the secondary hills, coal is very abundant. The strata of these mountains, immediately succeeding the vein of coal, consist of limy-flint mixed with clay, here denominated cannel-flint, and which breaks into a heavy lime, but requires to be flaked while hot. Above this mixture of lime and clay, are several strata of excellent iron-flint, of different degrees of thickness, with a soft flake, which interposes between the layers. The summit of the mountains is formed of layers of rock, called moor-flint. In the inferior hills, about the Glasart, is a large field of coal on both sides of the stream, at the depth, on the north side, of from two to fifteen fathoms, and on the south side, of twenty-two fathoms. The coal is, at an average, from forty-two inches to four feet in thickness. The adjoining parishes of Balderock, and the Kelvin, contain like abundance of coal and limestone. The coal resembles that of Newcastle, caking together, and giving out a strong heat when allowed to rest for some hours undisturbed.

The parish of Killyfirth contains also very valuable minerals in great abundance; and iron-flint, which was wrought by the Carron company upwards of thirty years since, still continues to be worked to a great extent. (See Carron and Iron.) In the westem part of the above parish are found great quantities of ball iron-flint, and considerable beds of limestone. In the Carron Glen is a large quarry of free-flint, soft and easily wrought when first drawn from the quarry. The bed whence it is taken is generally from ten to fifteen feet, and is placed upon a seam of coal about as many inches thick. There is a variety of slates arising, from thin slates like trees, from the surface of the earth. Some of them are fix, ten, or twenty feet long, in proportion to the depth of the free-flint; and they differ as much in diameter as in length, being of all sizes, from an inch to two feet. These are esteemed as considerable curiosities, and have furnished much matter for speculation. They exceedingly resemble a petrifaction, and yet the substance is not calcareous earth, but solid free-flint, of a similar texture with the circumjacent rock. One of the largest of them is described as being nearly sixteen inches in diameter, and about six feet nine inches in length.

Rivers.—Of the rivers in this county, the Forth is the chief, and though not the largest, has always been considered the most distinguished of the Scottish rivers. (See Forth.) The Carron river rises in the centre of the county, and running southwest, enters the Firth of Forth about three miles from Falkirk. (See Carron.) Bannockburn is more celebrated for the historical events that are connected with it, than for any importance it possesses as a river, being only a small stream. (See Bannockburn.) The lesser rivers in this county are the Avon, which rises in the south-eastern parts; the Enrick; and the Kelvin, which descends from the west and flows to the south-east; and the Blane, which gives its name to the parish of Strathblane, springs from a high hill called the Earl's feat, amid the Lennox hills. In a short course this river forms several water-falls, one of which, called
called the Spout of Ballagan, forms a cascade 70 feet in height, confined to a narrow channel, with lofty mountains on each side. This stream is sometimes increased to a torrent by violent storms of rain, which occasionally pour down like water-spouts. At such times, very considerable injury is done by the rapidity of the torrents, in overwhelming the low grounds.

Lakes.—This county contains no lakes of importance, unless Loch Monond be considered as partially belonging to it. In the parish of Buchanan, near Loch Monond, there are three small lakes, Dulochlan, Lochlarclaret, and Lochmanercarn. In the parish of Strathblane are six lakes; the largest of them, however, does not exceed half a mile in length, and a quarter of a mile in breadth; but they serve to feed a degree of liveliness upon a desolate region. In the parish of Kilcreith, the great reservoir for the canal between the Forth and Clyde, though artificially formed, may be considered as a lake. See Forth and Clyde Canal.

Soil, Climate, and Agriculture.—The soil of this county is extremely various, as may be expected in a territory so much diversified by hills and dales. In the western parishes, it generally contains a considerable portion of clay, that renders it cold, retentive of water, and productive of mosses and coarse grasses. The subsoil is mostly a hard till, impregnated by water, and an argillaceous kind of grit, of a reddish colour, blotted and streaked with white, grey, and yellow. The cafe lands consist of one of the most remarkable soils in the county. They lie in a low situation on the banks of the Forth, and extend from the river Avon on the east, to Kelly-water on the west; at an averaged space of about 30 miles in length and 2 in breadth. They are elevated from 10 to 20 feet above high-water mark, and a small portion of them is in some places overflowed at times by the river. The soil is universally allowed to be the alluvial deposited by the Forth and its tributary streams, and consequently to be the spoils of the higher grounds through which the river takes its course. It chiefly consists of a high-coloured clay, a small quantity of sand, and a pretty large mixture of once organized matter. In some places, there are patches of till of various colours; but not a stone so large as to obstruct the plough is to be found. The soil of the better quality, when dug fresh from the natural bed, is of a bright-blue colour, and of a substance resembling the richest soap, and sometimes even serves as a substitute for fuller’s-earth. In many places, the clay is excellently suited for the wares of the village, and forms the basis of stone-ware. The depths are from five to fifty feet; the subsoils are flint clay, hard till, and sea-shells in a natural state. The beds of shells are from a few inches to four yards in thickness; they are chiefly large oysters, with a mixture of cockles, whilkas, and some other shells at present found in the Firth. Patches of rich and fertile loamy soils are intermixed in different parts of the shire. Light gravelly soils are chiefly on the banks of the Enrick, Carron, Blane, and other rivers in the western and midland parts of the county.

The highest parts of Stirlingshire, as in other parts of Scotland, consist of a moor, extremely lofty when dry; but when wet, retentive of moisture. Of the many pastures in this county, some have been formed upon the kerse or low grounds adjoining the principal river, by the Romans having cut down the trees, which formerly grew here, and which formed the most formidable retreats of the natives. Where the moor is removed, these trees are found lying in all directions before their roots, which still continue firm in the ground in their natural position; and from impressions still visible, it is evident that they have been cut with an axe, or some similar instrument. That they were cut down by the Romans, is not only probable from the accounts which the historians of that people have given of their operations, but is confirmed by a circumstance that occurred in May 1768, when a large round vessel of this barks, and of curious workmanship, 25 inches in diameter and 16 inches in height, was discovered upon the surface of the clay, buried under the moor. It was denominated by the Edinburgh Society of Antiquaries, a Roman camp-battle.

The agriculture of this county is very varied. In the parish of Gargunnock, and elsewhere upon the Carse or Kerie, all estates consist of moor, dry field, and kerie farms. The dry fields occupy the space between the hills or moor and kerie grounds; and upon these, great improvements have of late been effected. The carse lands, which are all arable, are subdivided into farms from about 15 to 100 acres each; but those of 30 and 40 are most common. Farms in the higher part of the county are from 20 to 1000 acres, of which there is commonly a mixture of rough wet land, that is pastured only. Almost universally the farms are occupied by the persons who rent them. Small poifesions, from 2 to 30 acres, are to be met with in several parts, and in the old language of the country are still denominated gateis. These are generally occupied by day-labourers, who gain their livelihood by working on the high roads, or for the neighbouring farmers. Many of them are also in the possession of manufacturers or mechanics, for the accommodation of their families. Around the villages there are some considerable numbers of small properties held in feu.

In the Kerie, wheat is usually preceded by flummer-fallow; and much barley is reared. The cultivation of wheat is become very general. Peas and beans are little cultivated in the high parts of the county, but very generally in the Kerie as a mixed crop. Turnips, in the county, are extensively carried on towards the eastern part of the county. It appears from a memoir presented to the Board of Agriculture by William Wright, M.D. F.R.S. that potatoes were not planted in the open fields in this county, or any where else in Scotland, till about the year 1728, when Thomas Prentice, a day-labourer, first cultivated them in this mode in the parth of Kilcreith. About 13 or 15 years after this introduction, a Mr. Graham of that place cultivated them in great quantities for sale. He was the first who supplied the market of Glasgow with potatoes. Being very successful, his example in raising the large, round, reddish-coloured potatoe in the open field for the market was soon followed by many farmers; and the practice is now so universal, that they are even planted in strong clay land.

On some estates, the farm-buildings are substantial and well arranged, and a good situation is generally chosen. Dwelling-houses on many estates are two stories high, and are usually covered with slate or tile. About two-thirds of this county, exclusive of the moors, are supposed to be inclosed; and every description of fences, from high walls of stone and lime to neglected quickest hedges, are to be seen. One proprietor in the neighbourhood of Falkirk, has inclosed within eight years no less than 7000 Scottish acres. The fences are mostly of white-thorn, with double ditches, between which a mound or dyke of earth is raised. The ditch next the hedge is commonly five feet wide at the top, and three feet deep; the other is three feet wide. The dyke or bank between them is four or five feet broad at the base, and as much in height above the surface. The lines of the inclosures are all straight, at right angles with
one another, and many of them run in the same direction for several miles. The ridges follow the same course as the fences, for which the situation and the ground correspond remarkably well. Wet ditches alone are in some parts of the country supposed to be sufficient fences; several of them are ten feet wide, and of considerableness depth. It is believed, that the extraordinary dimension of these excavations has been owing to the long continued practice of procuring from them clay for various purposes.

The cattle of Stirlingshire are few; the inhabitants being supplied by the Highland dealers. A considerable part of the moors is patured with sheep, which are almost universally of the black-faced kind, and are called here the Linton breed, from the name of the village in Tweeddale whence they originally came. It appears, from the valuation of lands in the middle of the 17th century, that Ben Lomond, with the whole of the upper part of the parish of Buchanan, was almost entirely stocked with goats. A considerable portion of the rents, in those days, consisted of kid’s and goat’s milk cheese. Very few of that species of flock are now kept in the county.

Woods and Plantations. — Stirlingshire contains many coppices, that have been used as such from time immemorial. Torwood, in the parish of Dunipace, and the wood of the town of Falkirk, are generally believed to be the remains of the Caledonian Forest, with which the greatest part of this county, when the Romans invaded Scotland, seems to have been covered. The trees are principally oak, beech, hazel, and birch. Some of the oaks, when allowed to remain, grow to a great size. Of this, the county affords several examples. The most noted tree in the whole district was Wallace’s oak, in the midst of the famous Torwood. This tree, which, when entire, measured 12 feet in diameter, afforded in its trunk, hollowed by age, a shelter in the house of danger to that order who bears, and a part of his followers. The oak, the althorn, and the beech, are the most valuable trees in this county. Great attention has been paid, especially during the last 35 years, to rearing timber of all kinds. Plantations for shelter, ornament, and profit, form a considerable part of the improvement of the many estates which have been inclosed and improved since that period. The ground on which these plantations occupy, amounting to 2000 and 3000 acres. The trees generally planted are those best suited with various pines, especially the larch, which at the seven years old raises its head nearly double the height of any other tree of the pine genus.—Beauties of Scotland, vol. iii. Chalmers’s Caledonia, vol. i.

STIRPFING, a town of Austria; 4 miles N.E. of Weikendorf.

STIRRUP, or STIRROP, in the Manage, a reft or support for the horfemen’s foot, serving to keep him firm in his seat, and to enable him to mount.

The great art of a cavalier in the ancient tournaments was to make his antagonist lose his stirrup. For combating, it is a rule to have the right-foot stirrup somewhat shorter than the other.

Stirrups are allowed to be a modern invention; no mention being made of them in any ancient Latin or Greek author; no figure of them to be seen in any statue or monument; nor any word expressive of them to be met with in classical antiquity.

Menage observes, that St. Jerom is the first author who mentions them. This passage, however, is not to be found in his epistles; and if it were there, it would prove nothing, because St. Jerom lived at a time when stirrups are supposed to have been invented, and after the use of saddles. Montfaucon denies the authenticity of this passage; and, in order to account for the ignorance of the ancients with regard to an instrument so useful and so easy of invention, he observes, that while cloths and housings only were laid upon the horses’ backs, on which the riders were to stand, the stirrups could not have been used, because they could not have been fastened with the same security as upon a saddle. But it is more probable, that in this instance, as in many others, the progress of human genius and invention is uncertain and slow, depending frequently upon accidental causes. Berenger’s Hist. and Art of Horsemanship, vol. i. p. 65, &c.

To lose one’s stirrups, is to suffer them to slip from the foot.

Stirrup-foot is the near or left foot before.

Stirrup-leather is a thong of leather descending from the faddle down by the horse’s ribs, upon which the stirrups hang.

Stirrup-bearer, called in French porte étrier, is an end of leather made fast to the end of the faddle, to truss up the stirrup when the rider is alighted, and the horse sent to the stable.

Stirrup, in Ship-building, an iron or copper strap or plate, that turns upwards on each side of a ship’s keel and dead-wood, close forward or aft, and bolts through all. Stirrups are only used to British ships, when the after-piece of the keel is carried away by accident, and is replaced without the dead-wood bolts being driven through. See Rudder.

STISSIC MOUNTAIN, in Geography, a mountain of America, that lies between Connecticut and Hudson river, near which the Mahikander Indians formerly resided.

STITCH, in Agriculture, a term which in some districts signifies a ridge or but in a field which is under the plough. The forms and breadths of stitches are liable to vary according to the nature and uses of the land in different districts and places. In the county of Essex, their variation is said not to be considerable. In the most part of the western portion of it, the more wet land is laid out on two-bout ridges, or four-furrowed work; and a scattering of these is every where, it is laid to, to be seen: but on the strong land in the sea-districts, eight, as they are termed, or stitches of eight furrows, are more common. And towards the north of the county, ten-furrow work is rather more general. These form the chief varieties in respect to this matter. But there is a matter of forming the stitches in some instances, where they are laid by the plough in an admirable way. In particular cases, not one falf furrow can be seen, nor any form of tendency to any thing of the hog-trough kind, upon the whole extent of stitches on the farms: the form of the lands is perfectly correct, and so regularly and gently rounded, that not a drop of water can any where lodge upon them. It is difficult, it is thought, to plough lands of so fift a quality so thoroughly well. They are all ten-furrow lands or stitches, and the harrows and other tools for them are made for the breadth in a suitable manner.

Some farmers are particularly cautious in ploughing down old stitches or ridges, especially where the land is of the cold clayey kind, though others bring them down, without much hesitation or caution, in a gradual manner. Some have ploughed down high old stitches for the purpose of forming grazing-land, but have repeated it ever afterwards, considering that the staple of land is the artificial child of cultivation; and if it should be buried, and the under soil be brought up by such levelling, is injured for an age, or
for ever afterwards. They are consequently decidedly of opinion, that high lands or fitches should on no account whatever be ploughed down. They have often seen them laid to grass in their old form with great success, but scarcely ever when ploughed down. In such cases, if brought to good, paturage, it has been, it is thought, by force of manuring or top-dressing.

There can, however, be no fort of doubt, but that high and bad-landed formed lands or fitches in grounds may be brought down and reduced, in many cases, with considerable advantages in different respects, though it should always be done with a good deal of care and caution, as well as mooily, perhaps, in a regular and gradual manner.

STITCHEL, in Rural Economy, a term applied to a kind of hairy wool met with on some forts of sheep. See Sheep and Wool.

STITCHING, in Agriculture, a term applied to the forming of ridges in land, the same as ridging.

STITCHWORT, a name sometimes given to the alfine, or stiffularia of botanists, otherwise called chickweed. See Stellaria.

STITHY, or Stuthy, is used either for a smith's anvil, or a device in oxen, causing their skin to tick fo close to the ribs, that they cannot swin.

STIVA. See Thebes.

STIVER, in Commerce, a money of account and copper coin in Holland and Flanders. The gilders or florins of account contain 20 flivers, each of which is divided into 16 pennings. A fliver contains 2 groots Flemish, and 8 duyt; and a duyt, 2 pennings; a gold gilder, with which accounts are kept in the corn-trade, is worth 28 flivers. In flivers, there are pieces of 1 fliver; and in copper, duyts which are the 8th part of a fliver. At Antwerp, and the whole of Brabant and Flanders, accounts are kept mostly in florins and gilders of 20 fluivers, or flivers, formerly called Patars, which were formerly subdivided into 16 pennings, but for a long time have been divided into 12 parts or deniers. The smaller silver coins are the new pieces of 5 and 2½ flivers, and plaquettes of 5½ florins current. A piece of 5 florins is valued at 4½d., and a plaquette at 3d. See Coin.

STIVING, in Sea Language. See Steving.

STIX NEYSILD, in Geography, a town of Austria; 3 miles N.W. of Brugg.


Loueiru toppolos the Atinus, Rumph. Amboin. v. 1. 171. t. 66, to belong to the same genus. But that is an upright tree, with polyandrous or icofandrous flowers. If, indeed, there be no mistake in the author's account of the flamens in his Stich, it cannot belong to the natural order we have guessed, nor are we able to form any further conjecture on the subject.

ST. LAWRENCE COUNTY, in Geography, a county of New York, erected in March 1802; bounded on the N.W. by the river St. Lawrence, and the British possessions in Canada; E. by Franklin county; S. by Montgomery and Herkimer counties; S.W. by a small corner of Herkimer county, and by Lewis and Jefferson counties. Its extent on the St. Lawrence is 654 miles, in a right line; the E. line is 61 miles, the S. line 26, and the S.W. 43 miles; so that it has an area of about 2000 square miles. It is situated between 44° 5′ and 45° N. lat., and 70° and 1° 50′ W. long. from New York. Its number of towns is 12, the capital being Oswego, 212 miles from Albany; its population consists of 7894 persons. The soil is principally land or loam, thickly wooded with maple, beech, ash, tilia or bals wood, butternut, elm, and groves of white and yellow pines: it is not mountainous nor steep hilly; it is well watered by springs and streams, washed on the N.W. for an extent of 75 miles by the St. Lawrence, and penetrated by many navigable rivers. In the southern part are small lakes. This county sends one member to the house of assembly.

STOE, room, in Antiquity, the porticos at Athens. These were full of exedrae, cibae, and fide buildings, furnished with seats fit for fluidy or discourse. Here it is probable philosophers and their scholars used to meet. See Exedra.

STOAKED, in a Ship. When the water in the bottom cannot come to the well of the pump, they say, the ship is afloat, or floaked: so they say also, the timber-hales are floaked, when the water cannot pass through them; and that the pump is floaked, when something is got into it which chocks it up, so that it will not work.

STOAT, in Zoology, the name used by many for the animal whose skin is the ermine. See Ermineum Animal.


This genus consists of nine species, all natives of the Cape of Good Hope, only one of which had previously been described by Linneus. With this original species, Carlina atrafiloides of the Amanitaceae, v. 6. 96, the younger Linnaeus confounded two other very distinct plants, which are perhaps the S. glabra and rigida of Thunberg. The specific characters of this writer are too short and incomplete to determine the point; and we must content ourselves with giving all the information he has afforded.

1. S. glabra. Thunb. Prodr. 141. Wildl. n. 1.— "Leaves heart-shaped, clasping the stem, oblong, smooth".—We should rather have said "leaves oblong, smooth; clasping the stem with their heart-shaped base," which is the case with both the uncertain species alluded to above.

2. S. carthamioides. Thunb. ib. Wildl. n. 2.— "Leaves heart-shaped-oblong, smooth, with runcinate spinous teeth."

STOBER, a river of Silesia, which runs into the Elbe; 6 miles below Brieg.

STOBERA, in Ancient Geography, a town of India, which belonged to the people called Ichthyophagi.

STOBI, a town of Macedonia Salutaris, which succeeded that of Pelagonia, as the metropolis of this province. It was colonized by the Romans. Play.

STOBORHILL, or Stiborum Promontarium, (Marsel-Berber) in Ancient Geography, a promontory of Africa Propria, upon the coast of the gulf of Numidia, between the promontory Hippus and the town of Aphrodium.

STOBREZ, in Geography, a small sea-port of Dalmatia, near the coast of the Adriatic, on the site of the ancient Epetium, a colony of the Iliri; the ruins are still visible; 4 miles E. of Spalatro.

STOC and STOVEL, in our Old Writers, a forrestroute where any one is taken carrying signes and sublum out of the woods; for signes signes signifies signs, and sublum, sublum.

STOCK, in Commerce, a fund raised by a commercial company; or a principal sum of property employed in trade.

STOCK, in Book-keeping, denotes the owner or owners of the books.

STOCKS, or Public Funds, are the loans advanced to government, for which interest is regularly paid, from revenues set apart for the purpose. This mode of raising supplies by levying taxes for the payment of interest, is called the "funding system," and the loans thus raised constitute the "national debt." (See Public Funds and National Debt.) The debts of government differ from other contracts in this, that the public creditor can claim only his interest; he may, however, sell his stock, that is, he may transfer his claim, and thus obtain his capital, more or less, according to the price of stock, which fluctuates from various causes. The different funds or stocks are variously denominated, according to the terms on which they were established. Thus, fome are called the 3 per cent., fome the 4 per cent., others the 5 per cent., &c. And the manner of buying stock is to give a specific sum for a nominal hundred: e.g., if the price of the 3 per cent. be 60l., the sum is paid for 100l. stock, which yields a dividend of 3l. a year, that is 3 per cent. per annum; for at the same rate of 3l. for 60l., 100l. would yield 5l. When stocks are low, the interest is high; and vice versa. In some funds there is a higher interest than in others, and this is chiefly owing to the preference given to that stock which is most marketable, or the least likely to be redeemed; for government has an option to pay off or redeem certain loans, when an advantage may be made by such redemption. New loans are paid by infallments of 10 or 15 per cent. at stated periods, and they generally comprehend different kinds of stock, which together are called "omnium." If these be disposed of separately, before all the infallments are paid, the different articles are called "scrip." an abbreviation for subscription. In raising loans, a douceur is sometimes given by government of an anuity for a limited time: such are called "terminable annuities," and "irredeemable;" but the regular stocks, on which the common interest is paid, are called "perpetual annuities," and also "redeemable." Loans are called "funded debt," when taxes are appropriated for paying the interest; but sums raised for which no such provision is yet made, are called the "unfunded debt." Of this latter description are exchequer, navy, victualling, and ordnance bills, which are fills by these different offices, and bear an interest until they
they are paid off. The interest is mostly 3d. or 3½d. per day for every 100l.
Stock-Brokers. See Brokers.
Stock-Exchange Funds, an institution formed in the year 1801, for the relief of the decaying members of the Stock-exchange and their unprotected families. The annual subscription is one guinea, and that for life is 10 guineas. The annual relief does not exceed 40l. to any applicant; donations are restricted to 200l. Persons receiving any annual allowance are ineligible; and the allowance may be withdrawn if the party is no longer deserving, or if his circumstances have improved so that he ceases to be an object of charity.

Stock-Jobbing denotes the practice of trafficking in the public funds, or of buying and selling stock with a view to its rise and fall. The term is commonly applied to the illegal practice of buying and selling stock for time, or of accounting for the differences in the rise or fall of any particular stock for a stipulated time, whether the buyer or seller be possessed of any such real stock or not. This is that gambling at the Stock-exchange, which ruins numbers of people every year, and which is injurious, in a variety of respects, to individuals and the public. Transactions of this kind are declared to be illegal by an act of parliament “to prevent the iniquitous practice of stock-jobbing;” and no debt accruing from stock-jobbing accounts is recoverable at law.

Stock-Jobbing is a “lame duck,” so that he can no longer frequent the house, nor do any more business on credit, with his brethren. A stock-jobber, who has bought stock for time, which he never intended to take, is called at the Stock-exchange a “bull” laden with a burden which he wishes to shake off. On the contrary, he who has sold, upon speculation, what he does not possess, and consequently cannot transfer, is called a “bear.” Eager and hungry, and trying to devour the property of others. The first of these parties wants the fund he has bought to rise, that he may sell the same sum at an advanced price, and receive a profit, which is called the “difference.” It is his man’s interest to propagate false intelligence in time of war, of victories, negotiations for peace, &c. The bear, on the contrary, will endeavour to obtain false news of defeats by sea and land, in order to lower the price of the fund he has sold on speculation, that he may have an opportunity of buying the same sum at a lower price, and thereby receiving a profit. Thus by the various arts of the stock-jobbers, real property is affected, and the rise or fall of the funds is regulated by the jobbing accounts at the Stock-exchange. The greatest part of the national debt, consisting of 3 per cent. conf. annuities, in which most business is daily transacted, the greatest jobbing, and the most frequent variations, happen in that fund. All ranks of people, and persons of both sexes, engage more or less in stock-jobbing, often through the persuasion of their brokers; especially if they are known by transferring, or by purchasing, to have considerable property of their own. But persons of the most particular characters, and persons connected with them, have the best opportunities of playing a sure game, by means of early intelligence; and so they generally carry their gains out of the country: this is a great evil. Commerce likewise suffers considerably by stock-jobbing, for tradesmen are tempted, by the hope of more rapid profits than any they can make in the ordinary way of business, to frequent the Stock-exchange; and not being in the secret of obtaining true intelligencc respecting public affairs, they lose instead of gaining, and too often become fraudulent bankrupts. See Stock-Broker.

Stock, in Agriculture, a term signifying any sort of crop, or other kind of farm property. All kinds of stock of this nature should constantly be well fattened and adapted to the size, quality, and nature of the farms, so far especially as relates to tools, machinery, crops, and the different sorts of animals which are to be kept and employed upon them, whatever this fort may be; as, upon this being nicely and properly adjusted, a great deal in their economy and utility depends. It has now been long well known that very great advantages result to the farmer, from his thus accurately fitting his crops and live-stock of different kinds, as well as other things, to the estate, qualities, and circumstances of his lands; as they are found to be greatly influenced by them, and of course to be much benefited, where such a correct attention is had to the matter.

This has sometimes the terms of farm and farming stock applied to it, by different writers on husbandry.

Stock, Live, that kind which comprehends all sorts of domestic animals. See Live-Stock.

Stock, Live, Choice of Food for, the particular selection or choice of that fort to which they are attached, as being the most agreeable to them. The attachment or dislike to a particular kind of food, as shown by animals, however, it is said, affords no sort of proof of its nutritive properties in general; as different sorts of meat, fish, and other animals, at first refuse linseed cake, which is well known to be one of the most nourishing and fattening substances on which they can be fed; and the same is probably the case with some other matters used as food of animals.

The writer of the late work on “Agricultural Chemistry” has given the following remarks on the selection or choice of different kinds of common food, by sheep and cattle, on the authority of Mr. G. Sinclair, the gardener to his grace the duke of Bedford, at Woburn Abbey. With respect to rye-grass (leukium perenne), sheep, it is said, eat this grass, when it is in the early stage of its growth, in preference to most others; but after the seed approaches towards perfection, they leave it for almost any other kind. A field in the park at the above place was laid down in two equal parts, one part with the above grass and white clover, and the other with cock’s-foot and red clover. From the spring till midsummer, the sheep kept almost constantly on the rye-grass part; but after that time they left it, and adhered with equal constancy to the cock’s-foot part, during the remainder of the season. In regard to the cock’s-foot grass (daucus glomerata), oxen, horses, and sheep, are stated to eat this grass readily. The oxen continue to eat the straws and flowers, from the time of flowering until the time of perfecting the feed. This was exemplified in a remarkable and striking manner, in the field just alluded to. The oxen generally kept to the cock’s-foot and red clover, and the sheep to the rye-grass and white clover. In the experiments published in the “Amenitates Academicum,” by the pupils of Linnaeus, it is stated, it is said, that this grass is rejected by oxen. The above facts, however, is in contradiction with the results which is usually known by the title of meadow fox-tail grass (alopecurus pratensis), sheep and horses seem, it is said, to have a greater relish for it than oxen. It delights in a soil of intermediate quality as to moisture and dryness, and is very productive. In the water meadow at Priefley, near the above place, it constitutes, it is remarked, a considerable part of the produce of that excellent meadow. It there, it is said, invariably keeps possession of the top of the
the ridges, extending generally about six feet from each side of the water-course; the space below that, where the ridge ends, is filled with cob's-foot, the rough-flaked meadow-graft, the meadow fescue, the hard fescue, the agrostis foliifera and palustris, with the sweet-pectorated vernal grafs, and a small admixture of some other kinds. In speaking of the nature of the meadow cast-tail grafs (poe pratensis), it is noticed that it is certain that it is a grafs which is eaten without reserve by oxen, sheep, and hores. It is noticed, that it has been fayed by doctor Pulteney, that it is disliked by sheep; but that in pastures where it abounds, it does not appear to be rejected by these animals, but to be eaten by them in common with such others as are growing with it. In respect to the floren grafs (agrostis foliifera), in the experiments detailed in the Amencitats Academice, it is said that hores, sheep, and oxen, eat it greedily. On the duke of Bedford's farm at Maulden, floren hay was placed in the racks before hores, in small distinct quantities, alternately with common hay; but no decided preference for either was, it is said, manifested by the hores in this trial. But that cows and hores prefer it to hay, when in a green state, seems fully proved, it is thought, by Dr. Richardson, in his several publications on floren; and of its productive power in England, which has been doubted by some, there are satisfactory proofs. Lady Hardwicke has given an account of a trial of this grafs, it is observed, wherein twenty-three milch-cows, and one young hor, besides a number of pigs, were kept a fortnight on the produce of one acre of ground. In regard to the rough-flaked meadow-grafts (poe pratensis), oxen, hores, and sheep, eat it, it is said, with avidity. Hares also eat it; but they give a decided preference to the smooth-flaked kind, to which it is, in many respects, nearly allied. Respecting the smooth-flaked meadow-grafts (poe pratensis), oxen and hores are, it is said, observed to eat it in common with others; but sheep rather prefer the hard fescue, and sheep's fescue, which affect a similar soil. This, it is noticed, is a species of grafs that exhausts the soil in a greater degree than almost any other; the roots being numerous, and powerfully creeping, become, in two or three years, completely matted together; the produce diminishes, as this takes place. It grows common in some meadows, on dry banks, and even on walls. With respect to the crested dog's-tail grafs (cyonurus crifatus), the South-Down sheep and deer appear, it is said, to be remarkably fond of it. In some parts of Woburn park, it forms the principal part of the herbage on which these animals chiefly browse; while another part of the same park, that contains the agrostis capillaris and pneumus, flegia ovina, drumulius, and cambria, is seldom touched by them. But the Welsh breed of sheep almost constantly browse upon these, and neglect the crested dog's-tail, the rye-grafts, and the rough-flaked meadow-grafts. The fine, or common bent grafs, (agrostis vulgaris or capillaris), is noticed to be a very common grafs on all poor, dry, sandy soils. It is not palatable to cattle, as they never eat it readily, if any other kinds be within their reach. The Welsh sheep, however, prefer it, as has been just observed; and it is singular that these sheep, being bred in the park, where some of the best grafs are equally within their reach, should prefer these grafs which naturally grow on the Welsh mountains; it would seem to argue, it is thought, that such a preference is the effect of some other cause than that of habit. As to the sheep's fescue grafs (flegia ovina), all kinds of cattle are said to relish, and perhaps to have a sort of preference for it; but it is thought that it appears, from the trial which has been made with it on clayey soils, that it continues but a short time in possession of such kinds, being soon overpowered by the most luxuriant forta. It is suggested, that on dry shallow soils, which are incapable of producing the larger kinds, this should form the principal crop, or rather the whole; for if it is feld or ever, in its natural state, found intimately mixed with others, but by itself. Regarding the hard fescue grafs (flegia durifcula), it is noticed that it is certain that it is a grafs which is eaten without reserve by oxen, sheep, and hores. It is noticed, that it has been fayed by doctor Pulteney, that it is disliked by sheep; but that in pastures where it abounds, it does not appear to be rejected by these animals, but to be eaten by them in common with such others as are growing with it. In respect to the floren grafs (agrostis foliifera), in the experiments detailed in the Amencitats Academice, it is said that hores, sheep, and oxen, eat it greedily. On the duke of Bedford's farm at Maulden, floren hay was placed in the racks before hores, in small distinct quantities, alternately with common hay; but no decided preference for either was, it is said, manifested by the hores in this trial. But that cows and hores prefer it to hay, when in a green state, seems fully proved, it is thought, by Dr. Richardson, in his several publications on floren; and of its productive power in England, which has been doubted by some, there are satisfactory proofs. Lady Hardwicke has given an account of a trial of this grafs, it is observed, wherein twenty-three milch-cows, and one young hor, besides a number of pigs, were kept a fortnight on the produce of one acre of ground. In regard to the rough-flaked meadow-grafts (poe pratensis), oxen, hores, and sheep, eat it, it is said, with avidity. Hares also eat it; but they give a decided preference to the smooth-flaked kind, to which it is, in many respects, nearly allied. Respecting the smooth-flaked meadow-grafts (poe pratensis), oxen and hores are, it is said, observed to eat it in common with others; but sheep rather prefer the hard fescue, and sheep's fescue, which affect a similar soil. This, it is noticed, is a species of grafs that exhausts the soil in a greater degree than almost any other; the roots being numerous, and powerfully creeping, become, in two or three years, completely matted together; the produce diminishes, as this takes place. 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kind, it may serve to direct the proper and most useful means of preparing and laying down lands, for the purpose of pasturing and feeding fitch and flock in the best and most beneficial manner and succession as to the use and consumption of the food, as well as probably be of utility and advantage in some other ways.

For the nature, qualities, and properties, of the different forts of domestic animals which constitute the living flock of the farm, see Live-Stock.

Stock Account, that sort of account which is kept of the flock of a farm. It is of much utility and advantage to the farmer, in many different ways, that a correct account of the different sorts of flock on the farm be kept in a perfectly accurate and proper manner; as it not only shows how he stands in respect to profit and loss, but, in some measure, directs the management which is the best and most proper, as well as the most beneficial to be followed in different cases.

In order to accomplish the business in the most proper manner, a general flock-book should be kept; in which, at the close of every year, or at any other more suitable period, should be entered the result of a full and careful examination and estimate of the state, condition, and worth of the whole of the flock and property of every kind, as well as of the debts and credits which are existing. Such a book will at all times, and on all occasions, be of great value and utility for the purpose of referring to, and for affording the necessary satisfaction how every thing on the farm is going on, whether properly or improperly. In this intention, in the first place, all the different trackage, accounts and charges are to be got in, and the state and worth of the household property taken, but without any great degree of minuteness in this particular; then that all particular accounts made out for the hores, the rest cattle, the sheep, and other sorts of live-flock, with those for grain in the straw and threshed out, for hay and fodder of other kinds, for manure, for growing crops, for fallows, for timber-wood and woods, for ploughs, harrows, carts, wagons, harnesses, traces, stocks, and small implements of all sorts; concluding with the situation and state of the fences of all kinds, the gates, the drains, and water-courses, &c.; with estimates of the necessary repairs which they may stand in need of, on the side of the proprietor, as well as the tenant. Such memoranda being at first made out upon wise paper, the particulars of them may afterwards be copied and entered into the flock-book, in such a manner as may be considered necessary in regard to minuteness.

After the whole of this sort of work has been completed and properly adjusted, a debtor and creditor account may be made out in the manner of Stock Dr., and Centra Cr.; the balance of which will shew, in an exact and certain manner, the present state and worth of the farmer’s estate and property.

On the debtor side of this account is to be entered or put down all the farmer owes, beginning with rent, tythe, and taxes, and proceeding with other items; and on the contra, or contrary side, all he is possessive of every kind, and all which is owing to him. Everything is to be rated at what is thought to be the fair and just worth or value of it at the time: manure, and tillage-work which has been performed, are to be valued at what is considered the value of the particular district; and the corn which is not threshed out, and other similar articles, are to be taken by estimation at the fair rate which is then to be had for them. All other things are to be valued in the same manner.

There are several different modes and forms provided for keeping accounts of the farm kind; but for common farmers, the ordinary method is probably the most suitable, and may most be made fully sufficient for the purpose. Instead of the puzzling, though beautiful and correct, philosophical Italian mode, a sort of half that method has been advised, as both useful and unattended with either intricacy or trouble. It is merely that of creating or entering what are called flock accounts, in a ledger, without any of the connections by reference, common in that method. Thus, it is said, if a farmer wishes to be very correct in his accounts of the profit or loss, upon a lot of stalled oxen, for instance, or on the crop of any particular field, his book and readiest method is to make out an account, either for the one or the other, in his ledger, debtor and creditor. On the debtor side let him place the cost or expense, including every minute particular; on the creditor, the returns: in course, on the vale of the articles, the account is closed, and the balance demonstrates the profit or loss.

The keeping of both a day-book and ledger becomes necessary for the farmer; the first, in order to serve the purpose of affording necessary memoranda, as guides in the conducting of his business; and the latter, for shewing the general state of his affairs. But he need not be over nice or fudicious of forms, but enter down in the former whatever he may think needful, with the date; as, besides other things, the times when the males were put to the females of different sorts of domestic animals, as accidents are liable to frequently happen, for want of timely notice and care about the period of their bringing forth. It is also of vast use to keep correct accounts of the dates of different sowings, as well as of the various transplantations of the tillage and other kinds on the farm.

In fact, the regular taking of the flock of farms annually, at some certain period of the year, and of keeping fair and exact accounts, is, on the whole, when well and perfectly considered, attended with far less trouble and inconvenience, than the everlastling puzzle, confusion, uncertainty, and loss, of heedless negligence in this respect, but which is a great deal too common among farmers. Regular accounts and annual valuation will it is said, not only afford the farmer an exact knowledge of his real situation, but wonderfully sharpen and improve his judgment on the real worth and value of all those articles in which he deals, or has any concern; and in the necessary contemplation of the final event, he will have the satisfaction of reflecting that all stands fair for the benefit of his family, and as little liable as possible to loss or dispute in any way.

In a situation like that of a farm, where the whole homestead or residence is necessarily surrounded with different sorts of combustible matter, the insurance against accidents by fire should never, on any account, be neglected, or put off for even the shortest space of time. The accidents and deaths of different sorts of live-flock may likewise be probably insured against, both of which should, of course, form accounts in the flock-book.

Stock, in Gardening. See Stocks.

Stock, in Block-making, a wooden instrument used for boring holes, by fixing a bit in the lower end, and a pin with a round head in the other end; the pin and the bit serving as an axis upon which to turn it.

Stock of an Anchor, is composed of two long pieces of oak, tapering from the middle, fastened together with iron hoops and tree-nails, and fixed on the shank transversely to the arms. Some anchors have iron stocks.

Stock-Show, in Block-making, a large sharp-edged cutting-knife, with a handle at one end, and a hook at the other, by which it hooks in an iron-flaple, that is driven into
STOCKFIELD, a town of Sweden, in the province of Smalnad; 54 miles N.W. of Calmar.

STOK, a town of France, in the department of the Lower Meuse, situated on the W. side of the Meuse; 12 miles N. of Maestricht. N. lat. 51° 91'. E. long. 5° 45'.

STÖCKER, in Ichthyology, a name given by the Germans to the Salmo of the ancients, the trachurus of the later writers. It is a species of the tructor, known among us under the name of the brook-trout.

STOKE, in Geography, a town of Austria, on the left bank of the Danube; 12 miles S. of Sonneberg.

STOCKTON, a town of Sweden, the county seat of the province of Smalnad; 28 miles N.N.W. of Wexio.

STOKKEBY, a town of Sweden, the county seat of the province of Smalnad; 5 miles S.E. of Bareuth.

STOCKBRIDGE, a borough in Hampshire, England, is a small market-town on the eastern side of the Teff, and on the road from Winchester to Salisbury. The population, according to the report of 1811, amounted to 663 inhabitants, occupying 145 houses. A new bridge was erected here over the river Teff a few years since; about two miles to the westward, on Houghton-down, is a great race-course. Stockbridge is a borough by prescription, and its government is vested in a bailiff, who is the returning officer, a constable, and a sergeant at arms. This place sends two members to parliament, which privilege was first possessed at the commencement of the reign of queen Elizabeth; since which time, the members and voters have frequently been cited before the house of commons for corruption and bribery. This, indeed, is one of those boroughs which has brought the English representative system into frequent and severe reproach. The ingenious and learned sir Richard Steele was elected one of the members for this borough in the time of queen Anne; and obtained his election by flocking a large flock full of guineas, and declaring it should be the prize of that man whose wife should first be brought to bed after that day nine months. The two members are now elected by 57 voters, who receive, according to Oldfield, 6d. a man. (See a particular account in the Representative. Hift. vol. i. part ii. p. 507.) The right of election is in the inhabitants paying the church and poor rates. A weekly market is held here on Thursday; and there are three annual fairs. It is 66 miles W.S.W. from London, and 15 E. from Salisbury. The parishes of Stockbridge contain the borough, and Stockbridge-street, alias White-street.—Numerous journeys and travels. Hift. vol. iv. by J. Britton and E.W. Brayley. Oldfield's Representative History, vol. i. part ii.

STORK, a township of America, in Windor county, and state of Vermont, situated on White river, and containing 700 inhabitants. Also a post-town in the state of Massachusetts, and county of Berkshire. 44 miles W. by N. from Springfield. This is the chief township of the county, incorporated in 1739, and containing 1737 inhabitants.

STOTON, a town of Massachusetts, in Berkshire county, containing 1049 inhabitants.

STOWN, a tract of land, six miles square, in the S.E. part of Onondaga Reservatio, in the state of New York, inhabited by about 300 Indians, who some years ago removed from Stockbridge, in Massachusetts, and from this circumstance are called the "Stockbridge Indians." They are an industrious people, and are employed in agriculture, and in breeding of cattle and swine.

STOCKTON, a town of the Duchy of Wurzburg; 2 miles N. of Neustadt.

STOCKHEIM, a town of the district of Wurzburg; 4 miles E. of Kitzingen.

STOCKHEIM, Kasten, a town of the district of Wurzburg; 2 miles N. of Gerolzhofen.

STOCKHEIM, Tiefen, a town of the district of Wurzburg; 6 miles E.E.S. of Kitzingen.

STOCKHOLM, the capital of Sweden, is said to have been founded by Birger Jarl, regent of the kingdom, about the middle of the 13th century, during the minority of his son Waldemar, who had been raised to the throne by the states of the kingdom; but the court and royal residence were not removed hither from Uspal before the 17th century. The situation of this city is singularly distinguished by its romantic scenery. This capital, which is long and irregular, occupies, besides two peninsulas, even small rocky islets, scattered in the Mosel, in the streams which issue from that lake, and in a bay of the Baltic. The harbour is an inlet of the Baltic; the water of which is so deep, that ships of the largest burthen can approach the quay, which is of considerable breadth, and lined with spacious buildings and warehouses. At the extremity of the harbour, several streets rise one above another, in the form of an amphitheatre; and the palace, which is a magnificent building, crowns the summit. Towards the sea, about two or three miles from the town, the harbour is contracted into a narrow strait, and winding among high rocks, disappears from the sight; the prospect is terminated by distant hills, overspread with forests. The central islet, from which the town derives its name, and the Niddarholm, are the handomest parts of the town. Excepting the suburbs, where several houtis are constructed of wood, painted red, the buildings are generally of stone, or brick stuccoed white, mostly erected on piles. The palace, situated in the centre of Stockholm, and on the highest spot of ground, was begun by Charles XI., and the large principal stone walk of the façade of the palace are both elegant and magnificent. From an eminence in the south suburbs, called the "Mount of Moses," the spectator commands a bird's-eye view, almost unparalleled in its kind, of the city and various isles, of the harbour, the channel, and the lake Mäler, forming an assemblage of rocks, houfes, wood, ships, and water, in all the variety of rugged, beautiful, and romantic scenery. The several parts of Stockholm communicate with one another by 18 bridges.
bridges. The arsenal of Stockholm contains an immense number of standards and trophies, chiefly taken from the Imperialists, Poles, Russians, and Danes. The manufactures of this city are of glass, china, wool, silk, linen, &c; and the number of its inhabitants is estimated, by the latest accounts, at about 80,000. For an account of its academies, see Academy; and of its bank, see Bank. For other particulars, see Sweden. N. lat. 59° 20'. E. long. 17° 40'.

Stockhorn, a mountain of Switzerland, in the canton of Berne, the height of which is estimated at 7218 English feet.

Stocking, in Rural Economy, an improper practice with cow-jobbers, or dealers, consisting in obliging the cows to suffer the pangs of retention twenty-four, or sometimes forty-eight hours previous to sale, in order that they may have a great flow of milk in the udder. Such buyers, however, as know any thing of cattle, are fully aware of the custom, and consequently avoid the deception. The idea of any knowledge of the animal being more favourable for the purpose of milking, when obtained in this state, is highly ridiculous; as there are other better rules of judging, and which are familiar to every experienced stock-farmer. Many cows get inflamed and even indurated udders by such means. This unnatural practice ought of course to be generally reprobated and put an end to, as being productive of much mischief to these animals.

Stocking of farms, &c. In Agriculture, the means of first furnishing and providing them with all the different sorts or appropriate stock, according to their several natures and kinds, both of the living and dead forts, and of afterwards keeping them properly up, so as that all the necessary operations and management of the whole may be carried on in the most full, proper, suitable, and advantageous manner. It comprehends the providing of all the various descriptions of domestic animals for carrying on the work, as well as for keeping, feeding, or feeding off in the view of profit; and of the numerous tools, implements, machinery and carriages, as well as all other contrivances and things, which are requisite and proper in the husbandry. It is that matter which the farmer should next attend to, and which, much depends upon the several different kinds of stock being well fitted, suited, and adapted to the nature, size, state, situation, kind, and quality of the farms, whatever they may be, otherwise great inconveniences, losses, and disappointment, may be experienced.

In addition to what has been said on hiring and stocking of farms, under the proper head Farm, in speaking of and considering their general nature and management in these and different other respects, it will only be necessary to observe, that the farmer should seldom or never, on any account whatever, engage for more land as a farm, than what he has capital fully at command for stocking, managing, and carrying on with proper spirit, and in the best, most proper, and most beneficial manner; that he should, as seldom as possible, divert any of such capital from these its proper objects, to speculations of other kinds; and that he should never, in any material way, neglect the supplying of the different necessary sorts of stock, as they may become wanted on the farm, in the most suitable and appropriate kinds and quantities, as to their nature and extent, as well as the time of providing them. The improved methods of cultivation and farming in general, and the increased expenses of it, as well as the higher prices of tools, labour, and wages, and the vastly augmented state of taxation, render the charge of stocking in different kinds of farms, with all the different kinds of stock, mostly double, often treble, and in some cases nearly quadruple as much as it was twenty-five or thirty years ago. This should, of course, be constantly well considered and attended to by the farmer, before hiring and stocking any farm which he may be about to enter upon. See Farm.

In regard to stocking different sorts and qualities of land with different kinds of live-stock, in the view of keeping them merely, or those of feeding and fattening the animals, or in any other intention, it may just be noticed, that, for the most part, probably the best method is to run them neither too thickly nor too thinly upon the lands, but so as to have them constantly, without being either too full or too destitute of keep, no food being wasted or stock injured in either case, as there may be impropriety and loss in having the grounds too closely, heavily, or hard stocked, as well as in having them too thinly or lightly supplied with animals; though hard or heavy stocking may be necessary and useful in particular cases, circumstances, and situations, and with some particular kinds of stock. In the difference, however, between these two modes of stocking, it has not yet been well decided upon: for though some farmers are of opinion, and strongly contend, that light stocking is less hurtful to the land than close feeding, which renders it not so productive, by its not having such a length, or so much herbage upon it in the hot season, during the summer months; that a full bite of paturage is preferable, especially for some sorts of stock, which do best where there is a good portion of keep upon the land; that allowing the land to be well covered with herbage in the spring season, it is useful in promoting its growth in the summer, and by keeping it from the effects of the heat at that dry period; that it admits of the feeding of the grasses on thin poor lands, which renders them more strong, and the land more productive of herbage; and that the animals, where there is a full bite on the land, more quickly fill themselves, chew their cud more frequently, and, of course, feed or fatten more expeditiously; others, on the contrary, equally contend, that it is well known there are two modes of stocking which starve the animals, especially some sorts, as those of sheep, which are those of flocking towards, and too lightly stocked. In close stocking or feeding, times and seasons are to be considered and fixed upon; continual hard stocking at some periods may be injurious to the increase of the herbage of the land, as well as encourage the growth of plants of the most kind, while occasionally hard or close stocking, and not stocking at all, at short intervals, will prove more beneficial; that there is not so much wafte of food in close stocking, as by understocking, and the lands are more regularly fed down; that the young sprouts or shoots of grasses are more nutrient, and more powerful in fattening stock, especially of some sorts, while short than when long; that where lands are suffered, from light stocking, to become too luxuriant in their herbage in the spring season, feed items are thrown up, to the injury and mischief of the fertility of them; but where closestocked, and feed items are prevented from rising, there will be a greater retention of vegetable matter in the soil for the production of new sprouts and shoots; and that stock, especially of some sorts, are not found to lie down and rest themselves more often in lands which have much keep, from being lightly stocked, than in those which are hard stocked, and closely fed down; while they constantly prefer those parts which are in a close state of herbage, and become fat more quickly on it than where there is a great length of coarse rank herbage. In fact, the examination of the lands of those who are the most strenuous for light stocking, does
not prove that their flock is in any way superior, or carried on better, or fattened more quickly, than those in the same vicinity, who flock closer, or in a heavier manner.

In the business of flocking lands with live-flock, it consequently seems, that their nature, quality, present rate, and different proportions of different sorts, as well as the readiness of markets, and means of procuring and providing different sorts of flock, should be well and fully considered:—also the expenses of carrying the business on, and management with respect to them in all ways, the loaves that are attending the lands, and the advantages and disadvantages of different seasons in regard to them. The plans and methods of flocking for different purposes and seasons may thus be properly determined upon and adjusted, especially where the nature of flock, and the land on which it is to be fed, are sufficiently understood.

Stocking-Up, in Rural Economy, a term signifying to grub up or eradicate anything, as trees, hedges, woods, and other such similar matters. The work is mostly performed by means of the spade and mattock in different ways, according to its nature.

Stocking Island, in Geography, one of the Bahamas, about 15 miles long and 3 broad. N. lat. 23° 30'. W. long. 76° 20'.

Stockings, the clothing of the leg and foot, which immediately cover and screen them from the rigour of the cold weather, in winter.

Anciently, the only flockings in use were made of cloth, or of milled fluffs sewed together; but since the invention of knitting and weaving flockings of silk, wool, cotton, thread, &c. the use of cloth flockings is quite discontinued.

Mazerai says that Henry II. of France was the first who wore silk flockings at his first's wedding to the duke of Savoy, in 1550.

Dr. Howell, in his History of the World (vol. ii. p. 222.) relates, that queen Elizabeth, in 1561, was presented with a pair of black knitted flockings, by her flax-woman, Mrs. Montague, and thenceforth the never wore cloth ones any more. The same author adds, that king Henry VIII. ordinarily wore cloth hose, except there came from Spain, by great chance, a pair of silk flockings. His son, king Edward VI., was presented with a pair of long Spanish silk flockings by sir Thomas Grelham, and the present was then much taken notice of. Hence it should seem, that the invention of knitted flockings originally came from Spain.

How early the invention of knitting was taken up in Spain does not appear; but though it existed there in the time of Henry VIII., who died in 1547, yet it was not practised in England till the third year of queen Elizabeth, viz. 1561.

Others relate, that one William Rider, an apprentice on London bridge, seeing at the houfe of an Italian merchant a pair of knit worsted flockings, from Mantua, took the hint, and made a pair exactly like them, which he presented to William, earl of Pembroke, and that they were the first of that kind worn in England, anno 1564. Anderson's Hist. Com. vol. i. p. 326.

The modern flockings, whether woven or knit, are a kind of plexuses formed of an infinite number of little knots, called fitches, loops, or mebes, intermingled in one another.

Stockings, Knit, are wrought with needles made of polished iron, or braised wire, which interweave the threads, and form the meshes of which the flocking consists.

This operation is called knitting, the invention of which it is difficult to fix precisely, though it has been usually attributed to the Scots, on this ground, that the first works of this kind came from Scotland. It is added, that it was on this account, that the company of flocking-knitters, established at Paris in 1527, took for their patron St. Fiaccres, who is said to have been the son of a king of Scotland; however, it is most probable that the method of knitting flockings by wires, or needles, was first brought from Spain.

Stockings, Woven, are ordinarily very fine; they are manufactured by the frame or machine, made chiefly of iron, the structure of which is exceedingly ingenious, but also exceedingly complex; so that it is very difficult to describe it well, by reason of the diversity and number of its parts; nor is it even conceived, without much difficulty, when working before the face.

The English and French have greatly contrasted the honour of the invention of the flocking-loom; but the matter of fact, says Mr. Chambers, after M. Savary, in his Dictionary of Commerce, waving all national prejudices, seems to be this, that it was a Frenchman who first invented this useful and surprising machine; and who, finding some difficulties in procuring an exclusive privilege, which he required, to settle himself at Paris, went over into England, where his machine was admired, and the workman rewarded according to his merit.

The invention thus imparted to the English, they became so jealous of it, that for a long time it was forbidden, under pain of death, to carry any of the machines out of the island, or communicate a model of them to foreigners. But as it was a Frenchman who first enriched our nation with it, so a Frenchman first carried it abroad; and, by an extraordinary effort of memory and imagination, made a loom at Paris, on the idea he had formed of it in a voyage he had made to England. This loom, first set up in the year 1656, has served for the model of all those since made in France, Holland, &c.

But this account of the original inventor of the flocking-frame seems to be erroneous, as it is now generally acknowledged, that it was invented in the reign of queen Elizabeth, in 1589, by William Lee, M. A. of St. John's college, in Cambridge, a native of Woodborough, near Nottingham.

It is said that this gentleman was expelled the university for marrying contrary to the statutes of the college. Being thus rejected, and ignorant of any other means of subsistence, he was reduced to the necessity of living upon what his wife could earn by knitting of flockings, which gave a spur to his invention; and by curiously observing the working of the needles in knitting, he formed in his mind the model of the frame which has proved of such singular advantage to that branch of our manufactures. See London Magazine, vol. iv. p. 337.

Soon after Mr. Lee had completed the frame, he applied to queen Elizabeth for protection and encouragement, but his petition was rejected. Defparing of success at home, he went to France, under a promise of being patronized and recompensed by Henry IV.: and, with nine of his servants, settled at Roan in Normandy. But by the sudden murder of the French monarch, Mr. Lee was disappointed of the reward which he had reason to expect, and died of a broken heart at Paris. After his death, seven of his workmen returned with their frames to England, and in conjunction with one Aiton, who had been apprenticed to Mr. Lee, and who had made some improvements in his master's invention, laid the foundation of this manufacture in England.

In the space of fifty years the art was so improved, and the
the number of workmen so much increased, that they petitioned the Protector to constitute them a body corporate, but their request was refused. King Charles II. in 1663, granted them a charter, extending their jurisdiction to ten miles round London. See Company.

Such is the account given of this invention by Dr. Deerling in his Hist. of Nottingham, p. 100, who has also described the stocking-frame, and exhibited several figures of this machine, and of the numerous parts of which it consists.

The frame-work, knitters being Rocking-weavers hall is situated in Red-Croft street. They were incorporated 15th Augst. 1663.

In this hall is the portrait of the author of this ingenious art, pointing to one of the iron frames, and discharging with a woman who is knitting with needles and her fingers. These words are on the picture: "In the year 1580, the ingenious William Lee, A.M. of St. John's college, Cambridge, devised this profitable art for stockings, (but being depri
ded of his frame by the Queen, but to us and to others of gold and silver, of whom much is here passed.)" Hatton's View of London, vol. ii. 607.

Yet Dr. Howell, in his History of the World (vol. ii. p. 222.), makes this invention eleven years later, viz. anno 1600; and adds, that Mr. Lee not only taught this art in England and France, but his servants did the same in Spain, Venice, and in Ireland.

Mr. Lee's invention was made about twenty-eight years after we had first learned from Spain the method of knitting stockings by wires and needles; it has proved a very considerable benefit to the stocking manufacture, by enabling England to export vast quantities of silk stockings to Italy, where, it seems, says Anderson (Hist. Com. vol. i. p. 415.) by sir Joshua Child's excellent Discourses on Trade, first published in 1676, they had not then got the use of the stocking-frame, though not much less than one hundred years after its invention.

A late writer in the Bibliotheca Topographica Britannica, No. 7, says that Mr. Lee, after some years' residence in France, received an invitation to return to England, which he accepted, and that thus the art of frame-work knitting became known in this country. Thus, be it, the invention, he adds, is most generally received, though it has also been attributed to a Mr. Robinson, curate of Thorto

ston, in Leicester. The first frame, we are told, was brought into Hinckley, in Leicester, before the year 1640, by William Iliffe; and now the manufacture of this town is so extensive, that a larger quantity of hose, of low price, in cotton, thread, and worsted, is supposed to be made there, than in any town in England. The manufacture has since employed about two thousand five hundred and eighty-five working people; the number of frames has been computed at about one thousand, and there have been also about two hundred in the neighbouring villages.

The towns of Leicester, Loughborough, Nottingham, and Derby, with the villages in their dependencies, are the principal seats of the stocking manufacture in England.

About the year 1756, Meffins. Jedidiah Strutt and William Woollatt, of Derby, invented a machine, by which, when annexed to the stocking-frame, the turned ribbed

Stocking-frame. A most ingenious machine for weaving or knitting of stockings. To comprehend the action of this machine, which is extremely complicated, it is first necessary to have a perfect idea of the nature of the fabric which is produced by it: this is totally different from cloth woven by a loom, as the slightest inspection will show; for instead of having two distinct systems of threads, like the warp and the weft, which are woven together, by crossing each other at right angles, the whole piece is composed of a single thread, untied or looped in a particular manner, which is called stocking-fitch, and sometimes chain-work.

This is best explained by the view in fig. 1. Plate Stocking-frame. A single thread is formed into a number of loops or waves, by arranging it over a number of parallel needles, as shown at R: these are retained or kept in the form of loops or waves, by being drawn or looped through similar loops or waves formed by the thread of the preceding course of the work, S. The fabric thus formed by the union of a number of loops is easily unravellable, because the inflated cap of the whole piece depends upon the ultimate fate of the first end of the thread; and if this thread is detached, the loops formed by that end will open, and release the subsequent loops one at a time, until the whole is unravellable, and drawn out into the single thread from which it was made. In the same manner, if the thread in a stocking piece fails or breaks at any part, or drops a stich, as it is called, it immediately produces a hole, and the extension of the hole can only be prevented by fastening the edge. It should be observed, that there are many different fabrics of stocking-fitch for various kinds of ornamental hosiery, and as each requires a different kind of frame or machine to produce it, we should greatly exceed our limits to enter into a detailed description of them all. That species which we have repre

sentied in fig. 1. is the common stocking-fitch used for plain hosiery, and is formed by the machine called the common stocking-frame, which is the ground-work of all the others.

Fig. 2. is a perspective view of a common stocking-frame, exhibiting as many of its parts as can be seen in a general view. The body is a wooden frame, consisting of four pillars N, and various cross-pieces, called rafters: the two uppermost, M, are placed horizontally in the frame; the other parts of the frame are situated, being fastened in a frame of wrought iron. The pieces which compose the iron frame are two folle-bars w, which are supported upon the wooden caps M, and at the ends have joints, to support the plier-bows G, G, of which they shall soon have occasion to speak. At the back are two vertical standards, V, called the back standards, which support the axis T. These standards are united by back cross-bars, which are clearly seen in the figure near V. There are likewise two front standards W, erected from the folle-bars w, w.

To give motion to this machine, the workman seats himself before it, as shown in fig. 3, and puts the different parts of the machine in motion by his hands and feet. He applies his feet upon two treadles B, B, which have cords, b, c, 2 ac, ascending from them, and passing in opposite directions round a barrel or wheel, upon the axis of which is a large wheel, D, called the flyer-wheel. By alternately pressing down one treadle, and allowing the other to rise, he can turn this wheel round in either direction at pleasure. The object of this movement will be described hereafter. There is likewise a third treadle, E, upon which the workman presses his foot, when he wishes to bring down what is called the plier-bar, marked F, the use of which will be afterwards explained. This bar is attached to two arms or levers G, which are movable round the fixed centre pins or joints j. The ends of the levers are of a curved form; hence the pieces G are called the
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The preffer-bows. The connection with the tredle E is by a flagging or wire o, which ascends behind the machine, and is attached to the cross-bar H, which is extended from one of the preffer-bows to the other, and is cranked down, to avoid such parts of the machine as it would otherwise intercept in its motion. The return of the preffer and middle tredle, E, is produced by the re-action of the wooden spring 1, which is drawn into it with two sliding bars or some frames a counter-weight is used instead of the spring.

The weaver produces all the other movements by his hands for this purpose, he applies them to the ends K, K, of the hand-bar, and he can then very conveniently press his thumbs upon the thumb-plates L, L. By drawing forward or lifting up the hand-bar K, and at the same time pressing upon the thumb-plates L, or relieving them, he gives the requisite motions to what is called the frame of finkers, or simply the frame, because it contains the principal works of the machine. The thread of which the flocking is made is kept upon a bobbin M, flung upon in the front upright, N, of the frame, and the thread from this is carried upon the needles; and when it is woven into the flocking piece by the action of the needles and finkers, the piece hangs down at S, and is received upon a small roller fixed in an iron frame p, called the web, which is made sufficiently heavy to stretch the piece to a moderate tension.

As an introduction to a description of the whole machine, it will be proper to give the reader an idea of those parts which operate upon the thread, and of the motions which are given to them to produce the loops or meshes. These parts are the needles, the frame of finkers, and the preffer-bar: the needles are stationary, the rest moveable.

Fig. 1. represents what are called the needles: these are made of iron-wire, of the shape represented, and are hooked or barbed at the ends, the returned points of the hooks or barbs being made very delicate. There is a small cavity or groove punched or sunk in the item of the needle, immediately beneath the barb, of sufficient depth to receive the point, when an adequate pressure is applied upon the hook to bend the barb down. This barb then becomes closed eye, and if a thread is looped over the wire or item of the needle, and drawn forwards while the barb is thus closed, it will draw over the barb of the needle, and come off at the end of it: but if the thread is drawn forwards while the barb is open, it will be caught under the hook, and be thus detained, as shown at R. This circumstance must be particularly attended to, as the principal action of the machine depends upon it. The deflection of the barbs of the needles is produced by the edge of the preffer-bar F, which is extended horizontally over the whole length of the needles, and adjusted by preffing the foot on the middle tredle, as before explained.

Between every two adjacent needles, 1, 1, a thin plate of steel, 2, 3, is placed: these plates are called finkers; they are formed to a particular shape (as shown in fig. 4.), and are capable of being elevated or depressed, and also of being drawn backwards or forwards between the needles. These motions are given by the hands of the weaver, as the hand-bar K, which he holds, is part of the frame containing the jacks and finkers. The finker-frame consists of the hand-bar K, (figs. 2 or 4.), extending across it at the bottom; the hanging cheeks O, O, which form the upright sides of the frame; and the upper bar P, which is called the finkers-bar, because the finkers are fixed to it, being united several together in pieces of lead each an inch wide, which are cast round the ends of the finkers, and fastened by screws to the bar P.

To allow the frame of finkers to have the motions of which we have spoken, it is suspended by joints at the top of the hanging-cheeks, called the top joints: these joints are formed at the ends of the top arms, O, O, which are two horizontal levers fixed to an axis T, called the spindle-bar; the extremities of this turn on pivots, supported by the upper ends of iron uprights V, called the back standards. By the motion of the spindle-bar upon its centres, the finkers can rise and fall, and the quantity of this motion is limited by stop-screws applied to the vertical standards W. To draw the finkers forward between the needles, the finker-frame can be inclined upon the top joints of the hanging-cheeks, by drawing forwards the hand-bar K. From the middle of the spindle-bar, T, a short lever projects, which is borne upwards by a spring, Y, called the main-spring: this is supported by a piece which projects from the fixed cross-bar of the frame, and is of sufficient force to bear the frame of finkers upward, and give the top arms, O, O, a tendency to rest always against the upper stop-screws, X, of the standards W.

The hooked part or nips f (fig. 4.) of the finkers, are for the purpose of forming loops in the thread between the needles. To effect this, the nips, f, of the jacks and finkers are raised above the level of the needles, as in fig. 4., and the thread is extended across all the needles, immediately beneath the nips. If then the jacks and finkers are all pressed down between the needles, it is evident that the nips of the finkers must carry the thread down before them, and form it into loops hanging down between each needle, as shown at f. This, then, is the principal office of the finkers: but to perform the operation of flocking in the manner now described, by depressing the whole number at once, would not be practicable; because, as a greater length of thread is required when it is depressed into loops, than when it lies straight across the needles, it would require to draw the thread all at once from the bobbin M (fig. 1.), in sufficient quantity to make up the difference; to do which, the thread must slide or draw beneath the nips and the needles, which it could not do, on account of the friction.

The convenience to render this depression or looping down of the thread between the nips practicable is very ingenious. The row of finkers shown in fig. 4, is composed of two kinds, called jack-finkers and lead-finkers, which are very different in their movements, although we have hitherto spoken of them as one. The lead-finkers are all those of which we have spoken as being fastened to one bar P, called the finker-bar, which is part of the finker-frame, and which the workman moves by his hands: on this account, the lead-finkers all move together; they are one half of the whole number, and are disposed between every other needle, so that the space between each lead-finker has two needles in it. The jack-finkers are made of the same form as the lead-finkers, one being placed between each of the two needles contained between every lead-finker; therefore the lead-finkers and jack-finkers are disposed alternately to form a row, and a needle is placed in every space in the whole row. Each jack-finker is supported by a small lever, b i (fig. 3.) called a jack, freely movable on a centre-pin: the opposite end i, or tail of each jack, is preffed by a spring 1, which has a notch or indentation at a particular place; and when the jack is elevated, so that its nip, f, is above the level of the needles, i, ready to receive the thread, the end of the tail, 1, is received in the notch of the spring 1, which retains it in that position; but at the same time a flight force applied beneath the tail, 1, of the jack to lift it up will depress the nip, f, of the jack-finker, 3, between the needles. It is to be understood, that all the jacks, b i, are arranged in a row, and move upon one wire, which is a common centre of motion;
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motion; but the motion is given to them one at a time, beginning at one end of the row, and proceeding one by one to the other. To effect this, a straight iron bar, or ruler, called the flur-bar, is extended beneath all the jacks, and upon this is a piece of metal, m, called the flur, travels, with rollers to reduce the friction: it is drawn by a line extended from each side, and conducted over a pulley m, at each end of the bar l, to be carried round the flur-wheel D, fig. 2. We have before explained how it is given to this wheel, by the action of the two feet upon the two treadles B, C; it is plain by this connection, that the flur, m, can be made to travel from one end of the flur-bar, l, to the other, and in so doing, that it will elevate the tails, i, of all the jacks, i, b, beneath which it passes, and produce a corresponding depression of the jack-finkers, 3, between the needles. After the flur has passed, the jacks retain the position given to them by the prelure of the springs d.

The operation of linking or forming the loops between the needles is thus conducted: the nips of all the jinkers are raised above the needles, as in fig. 4; the thread is then extended lightly across the flures of the needles, beneath the nips f. By pressing on one of the treadles, B or C, the flur-wheel D is made to turn round, and this, by the flur-line, draws the flur, m, from one end of the flur-bar, l, to the other. In its passage it encounters the tails, i, of the jack, and lifts them up one by one, which at the same time depresses the corresponding jack-finker 3; and its nip, f, links the thread between the needles, and forms a loop. As these loops are formed successively, the thread draws easily beneath the nip to produce each single loop, and the workman allows the threads to draw off from the bobbin, M, through his fingers, as fast as it is required. When all the jack-finkers are depressed, a loop of the thread will be formed between every other pair of needles. The workman then depresses the lead-finkers, 4, by pulling down the hand-bar K, and their nips carry down the thread between the remaining needles in loops, in the intermediate spaces between the forms of the loops; in doing this, he causes the jack-finkers, 4, to rise up, as much as he depresses the lead-finkers 3; because it should have been mentioned before that the first loops formed by the jack-finkers were double the depth intended, although only half the number: by this means they contained the proper quantity of thread to form the whole number of loops; viz. one between every two adjacent needles.

The jack-finkers are caused to rise up by means of the locker-bar, p, extending over all their tails i. Each end of this bar is screwed to a lever, 2, called a locker, which moves upon the fame centre as the jacks, and the front ends of these levers are made with inclined ends, so as to be laid up by wedges fixed at the back of the thumb-plates, L, which move on joints fixed to the flur-bar, and hang down in a convenient situation to be acted upon by the thumbs of each hand, when holding the ends of the hand-bar K. The weaver, therefore, pulls back the two thumb-plates L, at the fame time that he depresses the hand-bar, K, of the frame containing the lead-finkers; by which means he produces the ascent of the jack-finkers, in an equal degree to the descent of the lead-finkers, until the nips of the two arrange exactly in one line, which position is determined by proper loops attached to the flur-frame. By this means, a complete row of loops is formed, one loop between each needle.

These loops are now to be carried backwards upon the needles, into the position of S, fig. 1, so as to occupy the arch or opening, s, of the jinkers, which open part is made purposely to admit the loops last made to remain upon the flures of the needles, quite detached from the action of the flinkers, which are at liberty to form a new course of loops by the nips, f, of their points t.

If we suppose the frame has been before at work, the loops last formed, which hang upon the flures of the needles, will not be a single thread, but the loops at the upper part of the work S, fig. 1: it is only when the frame first begins to work that the loops will be a detached thread, as we have just described.

But it remains to shew how the loops are put back upon the needles: this is done by merely lifting up the hand-bar K, till the points, t, of the jinkers rise above the needles: the hand-bar is then drawn forwards a little, to advance the jinkers so much, that the points, t, which were behind the loops of thread upon the needles, will now come before them, and then the hands are depressed, to inflect the points, t, between the needles again before the threads; and by pulling back the hand-bar, the points, t, carry back the work upon the flures of the needles, so that it will be finished in the arch, b, or opening, s, of the jinkers.

When the jinkers advance or recede, they must all move together both the lead-finkers and jack-finkers, as if they were one. It is clear that there is no impediment to the moving forwards of the lead-finkers, because they are at liberty to incline or swing forwards upon the joints at the tops of the hanging-checks, O, O, which suspense the frame containing them: but for the jack-finkers to advance at the same time, it is necessary to bring forward the jacks, and their centre of motion, together with the springs and flur-bar. To admit of this motion, all those parts are framed upon a strong bar called the camel; and upon this is placed four wheels, which run upon the sole-bars, so as to become a carriage. To communicate motion to this carriage, a link is joined to a piece at each end, marked r, fig. 2 or 4, which is screwed to the flur-bar P, just within the thumb-plates L. These links are jointed at the other ends to the common centre of motion of the jacks. The joints of the pieces, r, are so adjusted, that they will exactly line with the joints which unite the jacks and jinkers together; and the links are the same length between the centres as the jacks, for which reason they are called half-centre links.

By means of this connection, the carriage, with all its appendages, viz. the jacks, with their springs and the flur-bar, are drawn forwards at the same time that the flur-frame is drawn forwards, by pulling the hand-bar K K; or, by a contrary movement, the loops of threads which were last formed upon the needles, will be carried back from the hooks or beards of the needles upon their items, as shewn at S, fig. 1, so as to be in the arch, b, of the jinkers, as before described.

The first row of loops being thus disposed of, the frame of jinkers is restored to its former position, and a second row is formed upon the items of the needles by a repetition of the same process, viz. extending the thread across the needles beneath the nips, f, of the jinkers; moving the flur by the outside treadles B C, which depresses all the jinkers, and makes a loop of double depth between every other pair of needles: this is called drawing the jacks: next preffing on the thumb-plates L, and depressing the hand-bar, K, at the same time, which elevates the jinkers, and depresses the jinkers by one movement, and produces a loop of thread between every two adjacent needles. Another complete row of loops is now formed upon the items of the needles; and this row is to be brought forwards, so as to be under the beards or hooks of the needles, in the manner shewn by R, fig. 1. This is produced by simply drawing forwards the hand-bar K.
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which advances all the finkers together, and their points, 1, push forwards the thread till it comes into the beads, and these prevent it from coming off the needles.

The next operation is lifting up the hand-bar and frame of finkers as much as will raise their points, 1, quite clear up above the needles between which they were situated, and applying the foot on the upper treadle E, to bring down the finking-bar, F, upon the beads of the needles, to cloe them up, and while so closed, he holds the loops of thread at R, as if they were looped through the eyes of as many needles. The upper loops of the works which are at S, fig. 1, upon the items of the needles, in the arch, 1, of the finkers, are next brought forward upon the needles, by drawing forwards the frame of finkers; but in advancing these loops, draw over the closed beads of the needles, and consequently over the half-formed loops, which remain underneath the beads, in the position shown at R, fig. 1; or, in other words, the loops left formed, and resting under the beads at R, fig. 1, are drawn through the loops of the upper or half course of the finished work which remained upon the items of the needles, as represented at S. By this means, the loops of what was the upper or half course of the finished work, become secured from opening or unravelling, and the loops under the beads now become the last or upper course of the work, and are preferred from unravelling by the needles, one of which passes through each loop; and these loops will not be drawn off from the needles until there is another row of loops prepared, and referred under the beads of the needles, ready to be drawn through them.

When the piece of work is finished, and taken off from the frame, the last made row of loops must be secured by running a thread through them, or other means, or they would draw through the preceding loops, and release them, which in like manner would release their predecessors, and so the whole piece would unravel.

The motion of the frame of finkers, which produces the advance of the finkers towards the points of the needles, or their recessions towards the item, takes place upon the centres, called the top joints 0,0, and the wheel under the centres, as before mentioned. The quantity of motion is limited by a piece, fig. 7, called the arch, which is fixed fast against the inside of the wood-frame N, fig. 2, a part of the hanging-checks O,O, of the frame of finkers descends with a projecting part to act round this arch, which, at the same time that it limits the quantity of motion, prevents the motion being made, except in a proper succession, to produce the effects before described. Thus, when the hook is beneath the arch, the points, 1, of the finkers will be beneath the level of the needles, and then the frame of finkers cannot be raised up without first moving the lower part of the frame either forwards or backwards. In the same manner, when the hook is above the arch, the finkers cannot be depressed till they are moved. When the thread is first extended across the needles, in order to be sunk into loops, the frame is said to be over the arch, that is, the hook is at the back, or on the farther side of the arch, and by applying thereto, the finkers are guided in their sinking, that is, when they descend, they depress the thread to form the loop. When this sinking has taken place, the finker-frame will be at its lowest position, and the top arms, O, will rest upon the lower drop-crew of the standards W. When the finkers are brought forwards, to draw the loops from the items of the needles into their beads or points, the hook of the frame moves along the under side of the arch, and this prevents the points lifting up, while the lower stop prevents them from sinking down; but when the finkers are brought sufficiently forwards, the frame is lifted or thrown up by the main-spring, the hook following the curvature of the arch, until the points are completely above the needles, or the frame has reached the upper stop. The finkers are then brought forwards upon their centre of motion, while the preffer is drawn down to cloe the beads of the needles and draw the loops over them; in doing which, the hook quits the arch, and the frame moves forwards without any guide, the frame being unnecessary, because the motion of the finkers is determined by the upper stop, against which the frame rises by the action of its main-spring; and the proper degree for the advance of the finkers is determined by the drawing forwards of the frame with sufficient force to draw the loops of the work tight; this force the workman must regulate by habit, fo as make his work close.

In returning the frame of finkers, in order to put back the work upon the items of the needles, fo as to be out of the way while a new row of loops is made, the hook, 9, must be carried back beneath the arch, which will keep down the points of the finkers, fo as to prevent them from rising above the needles, as they would then quit the work they are intended to drive back upon the needles.

By the operation which we have described, one course of the work is formed; but, to render it more clear, we will continue the description, in a few words, of the working of another course. Preparatory to working it, the loops of the last course of the work, and by which the work is suspended from the needles, must be pushed back upon the items of the needles to the position S, fig. 1, fo as to come into the arched or open part, 1, fig. 4, of the finkers: this is done by depressing the finkers low enough for their point, 1, to enter between the needles, and then pushing back the hand-bar and frame of the finkers to carry back the work upon the items of the needles. This is the situation in which we suppose the frame, when the operation commences; and the frame is over the arch.

The first movement is the gathering of thread. The thread laid over is lightly extended across the needles, beneath the nips, 1, of the finkers; and by pressing the bar-treadle BC, the jack-finkers are depressed one by one, fo as to form double loops. This is called drawing the jacks.

The second movement is sinking. This is done by drawing down the hand-bar K, and bearing upon the thumb-plates, L, at the same time: the whole row of lead-finkers is thus depressed, while the jack-finkers rise, and the thread is carried down into a loop between every two needles.

The third movement is to bring the frame forwards under the arch. This is done by drawing the hand-bar forwards, and the row of loops just made is brought under the beads of the needles.

The fourth movement is to bring the work forwards from the item of the needles. To do this, the finker-frame is lifted up, by elevating the hand-bar K, so that the point, 1, of the finkers will be quite drawn out above the needles; and in this situation, the hand-bar and finker-frame being brought forwards, the breast or curved part of the arch, 1, of the finker will bring forwards the piece of work which hangs upon the items of the needles, by its loops last made.

The fifth movement is closing the work, or drawing the loops last made, through the finished loops of the work. The preffer-treadle E, being borne upon at the same moment, will bring down the preffer, and it will bear upon the beads, and cloe them, while the loops are drawn forwards; consequently the loops of the old work will be drawn over the beads, and quite off from the needles; this draws the loops thereof over the loops last made, which remain
main in the beards of the needles. To draw the work tight, the hand-bar, $X$, is drawn forwards two or three times with a slight jerk, so as to extend all the loops to their fullest quantity, and make the loops of the work unite closely.

The course is now finished; but as a preparation for making another course, the work must be carried back upon the stems of the needles into the situation of $S$, fig. 1. This is the sixth and last movement. To put back work, the frame is pulled down to bring the points of the finkers below the level of the needles; and in this position, by depressing back the hand-bar, and all the finkers together, the threads will enter between the ends of the needles, and carry back the loops of the work upon the stems of the needles, where it will remain in the arches of the finkers, so as to be detached from them, and out of the way, while a new set of loops is formed by the nips of the points of the finkers; and then the loops of the old work are to be drawn over those last made.

The movements are then repeated; 1st, gathering the thread upon the needles, and depressing it into large loops between every two needles, by the motion of the flor; 2d, finking, to make the loops between all the needles; 3d, bringing the thread under the beards of the needles; 4th, bringing the work forwards from the stems of the needles towards the beards, and changing the beards by the prelure of the plier-bar, and drawing the work over the beards; and, 6th, putting the work back on the needles, ready for working another course.

The operation of the machine proceeds in the manner described; and as each as the courses are completed, the work descends lower, and hangs down in a web from the needles. When the piece is of a considerable length, it is rolled upon a roller, in an iron frame $y$, called the web, and the weight of the frame is sufficient to keep the piece to a proper tension. The roller in the web can be turned round occasionally to wind up the piece, and is retained by a ratchet-wheel and click.

Having given an idea of the manner of the operation of this curious machine, it only remains to explain the adjustments with which it is provided, in order to make it work correctly.

The fineness of the work depends on the number of loops which the thread will make in any given length, and this will be equal to the number of needles and finkers in the same space. This number of needles in an inch is called the fineness of the frame, and changing the number of the finkers, which latter are used for the finest flockings. The gauge of a frame cannot be altered when it is once made, and the work which it will produce must always be of the same degree of fineness, although it may be made a little more dense or more open by drawing the loops very close, or by allowing a greater quantity of thread, and making the loops longer. This circumstance will evidently depend upon the depth to which the nips of the finkers descend between the needles, when they carry down the thread into loops. To regulate this depth, the needle-bar, or that piece which sustains the heads containing the row of needles, is made to rise or fall a slight quantity, by means of two long adjusting screws, the heads of which are made with notches, and springs fall into them to keep the screws from turning back; these heads are called the star, and the notches nick; one is marked $g$, in fig. 2 and 3.

The motion allowed to the frame of finkers is limited, as before-mentioned, by stops projecting from the two upright standards, $W$; and through these stops, stop-screws, $s$, are fitted, to regulate the degree of ascent and descent. The main-spring, $y$, is made of sufficient strength to lift the weight of the frame of finkers, and make them always rise up as high as the upper stop-screws will permit.

The manner of making different parts of the flocking-frame is worthy of notice. The needles are made of iron-wire, of a proper degree of fineness; it must be of good quality, so that which is liable to split or splinter, either in filing, punching, or bending, is totally unfit for the purpose. The wire is cut to lengths, and annealed or softened in a box of charcoal, in which they are heated to redness, and suffered to cool gradually; the needles are next punched with the small cavity which is necessary to receive the point of the barb: this is done by a simple screw-prefa. The point of the needle is next formed by the file and burrsifer, and the hooks are then bent to form the barb: next the needles are flattened, each with a blow of the hammer. To fasten these needles together, and fix them in the machine, they are placed parallel to each other in a mould or frame, and tin or pewter poured into the mould, round the flattened ends of the stems. The piece of lead or pewter is just an inch in width, and the number of needles which it will contain, gives the denomination to the gauge of the frame. These leads of needles are fastened to the needle-bar by a screw through each. The lead-finkers are made of steel-plates, which are put together by casting lead round them at the upper end of the frame. The rack, or piece, which contains the centre of the jack, is called the comb, because it is composed of a number of small plates, fixed into a bar by casting them with lead or tin.

The flocking-frame has undergone very few alterations since its first invention, a circumstance highly creditable to the genius of the inventor. A flocking-frame for weaving the tartan plaid hole which is worn in Scotland, is described in the Society of Arts Transactions, vol. xxix. p. 84: it contains some additions invented by Mr. John Robertson, at Stockport, in Cheshire, a town of Saxon, in the county of Chester; 3 miles S. E. of Chester, or south-east of the city of Chester, and 3 miles N. E. of Macclesfield, the county town of the county of Chester, and 3 miles W. of Macclesfield, the county town of the county of Chester, and 5 miles S. of Chester, the county town of the county of Chester.

STOCKPORT, formerly written Stokport and Stock-

PORT, a town in the hundred and deanery of Macclesfield, is situated 175 miles from London, on the banks of the river Mersey, partly in Cheshire and partly in Lancashire. The part of the town in the latter county is called Heaton-Norris, and is united to the Cheshire part by a bridge. In 1811 it comprised 819 houses, and 7522 inhabitants; whilst the remaining portion of Stockport contained 3326 houses, and 17,545 inhabitants. The population of the town and its neighbourhood is chiefly employed in various branches of the cotton manufacture. According to Melsa, Lysons's statement in 1810, there were then 25 factories for cotton goods, one silk-mill, and several establishments for the making of mullins. The parishes of Stockport contain fourteen townships, viz. Stockport, Bramhall, Bredbury, Brinnington, Dukely, Duncheonfield, Etchell's and Stockport-Eastfield, Hyde, Marple, Norbury, Offerton, Romiley, Turton, and Weaste. These are all populous, and appear chiefly to have been parts of baronies and manors; and there yet remains in some of them, armorial or architectural relics of their antiquity.

In the time of Edward I. Robert de Stockport, earl of Chester, made Stockport a free borough. In 1260 he also obtained a grant of a market, and an annual fair: at present there are four of the latter, and the former continues Friday and Saturday. Although there be no charter extant, yet a mayor is annually elected, or rather nominated, at the Lord of the manor's court. So soon as the Norman conqueror, the mayor of Stockport belonged to the De La Spenes;
it is now the property of Lord Viseount Bulkeley, in right of his lady. In the year 1773, the castle of this place was held by Geoffrey de Cottamene against King Henry II. It afterwards belonged to the Stockports, and subsequently to the earls of Warren; but the whole has been long since demolished. During the civil wars in Charles I.'s reign, Stockport was garrisoned by the parliament's army, and was considered an important post. In May, 1644, Prince Rupert appeared before it with his army; the garrison, to the number of 3,000, drew out to oppose him, but were repulsed, and the town taken. In 1745, Stockport bridge was blown up, to prevent the retreat of the rebels after their advance to Derby.

The places of religious worship at Stockport are, the parish-church of St. Mary, which, from the style of its architecture, appears to have been erected about the 14th century; the chapel of St. Peter, built and endowed, in 1768, by William Wright, esq.; a meeting-house for Presbyterians; another for Quakers; and several for Methodists. Near the town is a chapel for Roman Catholics, many persons of that persuasion, emigrated from Ireland, being resident here. The chief public institutions are, a free-school, founded, in 1497, by Sir Edmund Shaw; an almshouse, founded, in 1595, by Edward Wright; &c.; a dispensary, on a very enlarged plan, established in 1714; and several Sunday schools, instituted in 1714; one of which, conducted chiefly by the Methodists, is supported on such an extensive scale, that three thousand children are now educated in it wholly by gratuitous teachers; a large school-house erected by subscription in 1805.—Lyons's Magna Britannia, Cheshire, 4to. 1810. Beauties of England and Wales, vol. ii. p. 160. By J. Britton and E. W. Brayley.

Stockport, a town, or rather village, of America, in the state of Pennsylvania, and county of Northampton, on the W. side of the Popawtunk branch of Delaware river; from which is a portage of about 18 miles to Harmony, on the E. branch of the Susquehannah river.

Stocks, in Gardening, such young trees as are raised from seed, suckers, layers, or cuttings, and designed for the reception of grafts and buds of other trees, to continue them the fame and become trees in every respect like the parent trees from which they were taken. Stocks for general use are proper when from the size of a good large gooseberry, and the nature of the wild stock where the graft, &c. is to be planted, but they are sometimes used when two or three inches in diameter: these are made of use in most kinds of fruit-trees, and occasionally for some varieties of forest and ornamental trees, and many of the shrub kind: they should in general be species or varieties of the same genus as the trees with which they are to be grafted.

They are usually divided into three kinds; as crab stocks, free stocks, and dwarf stocks, each comprehending various sorts, both of the same and different genera, species, and varieties.

Crab Stocks.—These are all such as are raised from seeds, &c. of any natural or ungrafted trees, particularly of the fruit-tree kind; such as the crab-apple of the woods and hedges, any kind of wild thorny uncultivated pears, plums, wild black and red cherry, &c.; and also of such trees as have been grafted or budded: some sorts, being strong shoots and hardy, are preferred, on which to graft particular species, to improve the size and duration of the tree; for example, apples are very commonly worked upon the common wild crab stock, and cherries on the great wild black and red cherry stock, as tending to promote a large, hardy, and durable growth, proper for common standards and the larger kinds of dwarf trees. In using crab stocks to graft any sorts of fruit-trees, it is proper to reject such of them as assume a very wild crab-like growth, or of a flinty, thorny nature, preferring those that are the freest clean growers: sometimes, however, the appellation of crab stocks is given to all stocks indiscriminately, before being grafted, whether raised from the seed, &c. of wild or cultivated trees, until worked with grafts or buds, but with the dillinctions of wild crabs and free crabs.

Free Stocks.—This is a term commonly applied to such sorts as are raised from the kernels of the fruit, layers, &c. of any of the cultivated garden and orchard fruit-trees, and others, which often in general culture are commoner than the wild crabs, and are more proper than they for grafting choice apples, pears, peaches, nectarines, apricots, and plums upon, to improve the growth of the trees and quality of the fruit.

Dwarf Stocks.—These are such sorts as are raised from low growing trees, of a shrub-like nature, or but very moderate tree-growth, being used for the lower and middling sorts of standards and to form dwarfs, either for walls or espaliers, or as dwarf standards in small gardens, and others, which often in general culture are commoner than the wild crabs, as they never attain a large growth, sufficient to produce any considerable quantity of fruit: the codslin dwarf stocks, quince stock, morello stock, and small May cherry stock, for cherries; the bullace and mullel stock for dwarfing apricots, peaches, and nectarines, and sometimes dwarf-almond stocks for the latter, when designed to have the trees of a very dwarfish growth, either to pot for curiosity, or for forcing in small forcing-frames.

But the most dwarfish kinds are: the paradise stock, bird-cherry, black bullace, and dwarf-almond; but they are not so proper in general culture as common dwarf trees, as they never attain a large growth, sufficient to produce any considerable quantity of fruit: the codslin dwarf stocks, quince stock, morello cherry, and mullel stock, are proper for the middling or larger kinds of dwarf trees, either for walls or espaliers, or dwarf and half standards: they are all raised from suckers, layers, or cuttings.

Sorts of Stocks adapted to each Kind.—For apples, in all the sorts of dwarfs, they are tho' of their own sort, raised from the kernels of any of the cultivated apples or crab for common standards, and the latter freely by suckers, layers, and cuttings: the early sorts being preferred for the general supply of lower trees, for all common standards, and the larger dwarf pear-trees for extensive walls and espaliers: the quince stock is estimable principally for its dwarfing property, or in being productive of moderate fruiting trees for walls, espaliers, or middling standards, sooner arriving to bearing growth. In order to form dwarf pears, white thorn stocks, raised from seed, were formerly sometimes in repute, but they are very improper, as the trees rarely proper.
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prosper well; as the goodness of the pear is often improved or diminished by the nature of the stock on which it is grafted, it is of importance to use free stocks, raised from the kernels of the best summer and autumn pears, as much as possible; and the prime pears should be worked always on the finest tree-shoots of the most cultivated-like growth; sometimes, to improve the quality of particular choice kinds of pears, it is the practice to double-work them, which is to graft the best roots into free stocks in the spring, which shoot the same year; then about midsummer, or soon after, to bud the young shoots of the graft with buds of the prime roots of pears, suffering only the shoots from the second budding to run up to form the tree: the breaking kind of pears are often rendered less hard and flomy in this way, and the melting property of others is considerably improved. See Pyrus Communis.

And for quinces, two sorts of stocks are occasionally used, as that of its own kind, and the pear stock; the quince stock is raised from seed, suckers, cuttings, &c., and the pear kinds from the kernels of any sort of pears; but as all the varieties of quinces are so expeditiously raised with certainty the same by layers and cuttings, it renders the raising of stocks for grafting or budding them on almost unnecessary. See Pyrus Cydonia.

Also for plums, the operation is performed only upon stocks of the largest dwarf sorts, raised from the stones of any sort of cultivated plum, or by suckers and layers, as the most certain methods to obtain any particular variety of free plum stock, as the muscle-plum stock, which many prefer as the best root of all on which to work the finer kinds of plums, as generally producing very thriving moderate growing fruitful trees; raising it, not from seed, which would very exceedingly, but by suckers from the root of real muscle-plum trees, or of those upon the true muscle stock, or from layer stocks of the muscle-plum tree: the plum will also grow upon the apricot and cherry stocks, but not in a thriving state for any length of time. See Prunus Domestica.

For cherries, the proper stocks are those of the cherry kind only; as the great wild cherry stock for large trees, the cultivated garden cherries for the more moderate growths, and the bird-cherry stock for small dwarfs: the two former are raised from the stones of the fruit, and the latter also by seed, or by layers and cuttings: for general use, the wild black and red cherry stocks, being strong free growers, are preferable for all common large standard cherries, also the larger dwarf trees for extensive walls and espaliers; as these stocks, being of strong hardy growth, generally produce larger, more hardy and durable trees than the cultivated cherry stocks; sometimes stocks of the moretol and May cherry, as being moderate growers, are used to raise the smaller cherry-trees upon, either in dwarfs for low walls and espaliers, or for small moderate standards; but the former, when raised from layers, is more certain of producing the real root in its naturally moderate growth: the common bird-cherry, as being a very moderate grower, is used for standard cherry-trees on, either to plant in borders, pots, forcing-frames, or for pot for forcing, &c.: they are raised plentifully from seed, cuttings, and layers; and have the effect of dwarfing trees exceedingly, so as to bear fruit when but one or two feet high; and shooting very little to wood, generally bear abundantly for their size: and cherries will also grow upon plum, apricot, and laurel stocks, as being of the same genus. See Prunus Cerifusa.

For apricots, these prove the most durable on stocks of the plum kind, as common plum stocks of any variety for all common wall, espalier and standard trees; and the bul-

lace stock for small dwarfs; the plum stocks are raised from the stones of any kind of cultivated plum, or by suckers from the root; and the bullace from seed, suckers, and layers: though they succeed almost equally well upon stocks of any kind of plum, it is probable they may prove the most successful on the muscle-plum stock, like peaches, &c., as being of a more moderate regular growth, and more prolific nature; the bullace stock is only used occasionally to raise moderate small dwarfs for low walls, or to plant in pots, or in forcing frames for forcing: the apricot will likewise grow upon its own, and on peach and almond stocks raised from the stones, but never in so prosperous or durable a manner. See Prunus Armeniaca.

For peaches, several sorts of stocks are occasionally used; as almond, peach, nectarine, apricot, and plum stocks; they are all raised from the stones of the fruit, and the latter also by suckers and layers; but the plum stock, being the most hardy, is the most proper for general use; but the free plum stock is preferable for all the sorts of peaches and nectarines, as being productive of the most hardy, thriving, and durable trees; though it is remarkable, one sort of plum stock in particular is generally preferable on which to work peaches, which is that of the muscle-plum, as producing the most prosperous trees, and of a more moderate, regular, and fruitful growth, the fruit being of a superior quality of pith and flavor in genuine; being raised from suckers or layers of the true muscle-plum tree, or by suckers from the roots of such peach, nectarine, plum, &c., as are worked on muscle-plum stocks, which generally send up plenty from the roots annually, planting them off at one year's growth into the nursery to train them for use: double stocks, or double working, is sometimes used for the more delicate peaches, to improve their bearing, and the flavor of the fruit.

For nectarines, the same stocks as in the peach are used: as almond, peach, nectarine, apricot, and plum; all raised as for the peach-tree: the plum stock should be preferred in general as for peaches.

For almond-trees, when raised for their fruit, the approved varieties may be budded into stocks of any sort of almond, peach, nectarine, apricot, or plum, raised from the stones, and the latter also from suckers, &c.; but the trees are generally the most hardy and durable on plum stocks. See Amygdalus.

For medlars, three or four different stocks are occasionally used, to raise the approved varieties: as the medlar, white-thorn, pear, and quince stocks; the three former raised from seed, and the latter from suckers, layers, and cuttings: the medlar feeding-raised stocks are very proper to graft the approved varieties; and the white-thorn and quince stocks are only used occasionally: but free stocks, raised from the kernels, of medlars, or summer or autumn pears, are preferable to the two last for all the varieties of the common medlar, which, either on their own or pear stocks, generally assume a more free growth, and produce the fruit in greater perfection and abundance. See Mespilus.

For sweet service-trees, we either, or on the fruit-trees, the approved varieties should be grafted or budded upon proper stocks; either principally their own raised from the seed, or occasionally on pear or quince stocks, raised as for the medlar and other trees; though any of the forbus, or the pear kind of stocks, are preferable to the quince to work this tree on to have it large and durable; but quince stocks may be used to have tree's smaller growth, for low standards, espaliers, &c.

For the wild maple-leaved service berry-trees, the proper stocks are either their own kind, or those of the hawthorn,
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thorns, raised from the seed; they also take upon pear
stocks, &c.

For hazel-nuts, the fiber, &c. the stocks of the com-
mmon nut-tree, raised either from the nuts, or by suckers
from the root, may be used; but this method is seldom
employed. See Corylus Avellana.

For orange-trees, these are worked upon stocks of their
own kind only, as any kind of orange, lemon, or citron
stocks, raised from the kernels of the fruit; though the
Seville orange, as being a very free strong shooter, is gen-
erally preferred for orange stocks; but the lemon and citron,
being also free growers, form very proper stocks to raise any
variety of oranges on. See Citrus Aurantium.

For lemon and citron trees, these varieties are also budded
or inarched upon lemon, citron, or orange stocks, raised
from the kernels of the fruit, as for oranges. It is evident,
that in this method, for curiosity, the same stock may be
made to support two, three, or more different varieties of
fruit, grafted or budded, either all into the stock, being
previously trained with branches, forking off for the pur-
pouse one for each graft, or by cleft or crown grafting
single large stocks, with two or more different buds by in-
culation; likewise the stock being singly grafted or budded,
different sorts may be inserted into the shoots arising from
the graft or buds; and thus two, three, or more sorts of
apples may be had on the same root; and by the same me-
thod, two or more sorts of fruits may be had upon the same
stock, as plums, cherries, and apricots all on a plum stock;
or peaches, nectarines, and apricots on the same, or on
stocks of their own kind; and pears, medlars, and quinces
upon the pear stock; also red and white currants, or cur-
rants and gooseberries, on a currant or gooseberry stock;
or white and red grapes on a vine stock; likewise red and
white roses, or other different sorts, upon a common rose
stock; as well as upon numerous other trees and shrubs, which
are species or varieties of the same genus. See Citrus
Medica.

Method of Raising the Stocks.—All the different sorts may
be raised by seeds, suckers, layers, and cuttings. In the first
or seed mode, various sorts of stocks may be raised from the
flowers of different sorts of trees; as the kernels
of all the apple kinds, pears and quinces; and the
flowers of plums, cherries, apricots, peaches, and nectarines;
the seeds or flowers of medlars, services, &c.; also nuts,
when designed for stocks; all of which should be obtained
in autumn from their respective fruits when fully ripened;
and when well cleared from the pulpy substance, each sort
may be sown separately, in beds of common light earth in
the nursery, either directly, or after being preserved in sand
until February, but the early autumn is the best season; and
if the winter should prove severe, the beds of the more tender
kinds, as almonds, peaches, &c. may be covered with dry
litter to defend the seed from the frost. See Nursery.

But before the appearance of the plants above ground,
where the surface of the bed is hard-bounded or caked, it is
often beneficial to flir the surface lightly with a small iron
rake; also, if very dry weather prevails, to give frequent
small waterings, both before and after the plums are up,
repeating the waterings occasionally in dry weather all the
spring and early part of summer, to encourage a free strong
growth; being likewise careful to keep the beds very clean
from weeds, by diligent hand-weeddings; and by thus giving
every encouragement, the feeding stocks will grow so
freely during the summer, as, by the autumn or the spring
following, to be mostly of a proper size to plant out into
nursery-lines in open quarters, in rows two feet asunder,
for remain for grafting and budding upon; though, if they
have made but middling progress the first summer in the
feed-bed, and are rather small and weakly, the strongest
only should be planted out, leaving the rest growing until
the next autumn, when they will be all of full size for plant-
ing out wholly into the open prepared nursery quarters,
and the feeding plants up out of the beds, shortening any
perpendicular tap-root and long stragglers, but leaving all
their tops entire, and then planting them in lines, either
by trench-planting, slit-planting, or dibble-planting, as the
sizes of the plants admit, in rows two feet or two feet and a
half asunder, setting the plants one foot or fifteen inches
apart in each row, in an upright position; and after having
planted one row, treading the earth gently all along close
to the roots of the plants, to fix them firmly in the earth
all evenly in a straight range; proceeding in the same manner,
row and row, till the whole is planted, levelling the surface
of the ground between all the rows with the spade or rake.
Their future culture, until grafted or budded, consists in
occasional waterings in the first spring, hoeing over the
ground every summer, digging between the rows annually
in the winter or spring, and training the stocks each to one
item; preferring their top always entire, but trimming off
the strong laterals below, to encourage the strength of the
main item, when they will be fit for grafting or budding
upon, in from one to two or three years. See Planting,
In Gardening.

It may be noticed, that they are proper for working
when from about the size of a large goose-quill, as already
observed, to the thickness of a man's little finger, or a little
more; but the sooner they are worked upon, after they are
of a due size, the better they succed, and the sooner they
form trees. See Grafting and Budding.

In some cases, however, where the stocks have shot freely
the first summer after planting out from the feed-bed, many
of them may probably be of a due size to graft the fol-
lowing spring and summer, at five or six inches height, to
form dwarfs for walls and espaliers, &c. or even, in some
stocks, for full or half standards, provided the first main
shoot from the graft or bud is trained up singly, two or
three years, to form the item, of from four or five to six or
seven feet stature; however, if they have grown but moder-
ately the first and second seafons, and are not generally
in a condition for the operations of grafting or budding,
it is better to let them have another year's growth.

But in the second or sucker mode, the suckers of all the
trees which afford them should be planted off at one year's
growth, in autumn, winter or spring, which is a very ex-
pedient method of raising several sorts of stocks; so that,
after being transplanted into the nursery, they often, in one
or two years' growth, afford proper stocks for the reception
of grafts and buds; and many of them are often fit for bud-
ding in the summer following, at the proper budding season,
or for grafting in the spring afterwards.

The suckers are generally fit to take up for the purpose
of stocks, when of one year's growth, and about the size of
a tobacco-pipe, or but little bigger, and should be collected
in autumn, or the early part of winter; taking them up as
well rooted as possible, and after they are taken out, the
knobbed or tuberous parts of the old roots that may adhere to
their bottom, trimming the straggling fibres, and cutting off
all side-flotes from the item; then planting them in rows two
feet asunder, and one foot distant in the lines; treading the
mould gently to their roots, and finishing the work by levell-
ing the surface between the rows. The culture afterwards,
until grafted or budded, is nearly the same as that of the
feeding stocks, keeping them clean from weeds in summer
by hoeing, and probably some of the strongest shoots may
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may be fit to bud in the July or August following, though the general or greatest part will require two years' growth, before they are proper for working; still continuing them all to one stem, by the time displacing strong laterals, and preferring their top or leading shoot generally entire until grafted, &c.

The third or layer method is practiced for some sorts of flocks of fruit and other trees, and when any particular variety of flock is required, such as the paradise flock for apples, mulberry for peaches, &c. that they may be obtained of the real flock with certainty; but as this method of raising flocks would be attended with great trouble for general grafting or budding, it is only practiced occasionally. In providing them in autumn or winter, some of the young shoots of such trees as have the branches naturally growing near the ground, or in which the items have been cut down low while young, to force out branches near the bottom, to furnish shoots properly situated for laying, should be filled in the common method, when they will mostly be rooted by the autumn following, and be fit to take off and plant into the nursery, being managed as directed for the laying of flocks, &c.

In the last or cutting method, cuttings of the last year's shoots should be chosen in autumn, planting them in the nursery, in a somewhat shady border, giving occasional waterings the following spring and beginning of summer, in dry weather, when they will be mostly well rooted by next autumn, and may then be planted out in nursery-rows two feet afar, managing them as the others. They should be kept with upright items, except any should assume a fluted or crooked growth; in which case, they should be pruned down to the ground in the spring, when they will put out strong from the bottom the ensuing summer, training them to one item, and with their leading top-shoot entire as above; and according as all the sorts advance in growth, they should be deflected of strong lateral flocks below, repeating it particularly in the taller standard flocks, to encourage their upright direction more expeditiously to the proper grafting and budding heights. But the proper methods of grafting and budding, for the different sorts, are shown more fully under the culture of the different kinds, as well as under the heads Budding and Grafting.

It is related to flocks in general, but little that is satisfactory has yet been done, in either determining the utility and advantages of such as are taken from different species of the same kind, or in any other way; but an ingenious inquirer on horticultural subjects, T. A. Knight, esq., has lately been engaged in some experimental trials for ascertaining the advantages or disadvantages of using flocks of different species in the culture of the peach, the nectarine, and the apricot, which may probably throw some additional light on this intricate and imperfectly elucidated practice. It has been stated by this writer, on the authority of Sir Joseph Banks, in the "Transact of the Horticultural Society of London," that in the practice of the French gardeners, they consider flocks of different species to be necessary to correct the defects of different soils and varieties of fruit; and that the peach-tree should, in some cases, be budded upon the plum-tree, in others upon the almond-tree, and in others again upon its natural flock, that of the apricot; while, on the contrary, our gardeners supplant the plum flock to be, under all circumstances, the best adapted to the peach; and still further, that Du Hamel, to whose opinion the greatest deference is constantly to be paid, pronounces the plum flock as never to be eligible, and affirms that he has seen the peach-tree thrive upon flocks of the apricot, in soils where it would not succeed either upon the almond or plum flock. It is also stated by the last writer, that it is said to be the common practice of the French gardeners, that the peach-tree, when grafted upon its natural flock, is more liable or subject to generate gum, than when it grows upon a flock of another species; and that, whenever the tree is confined to a small space, and consequently closely pruned, this opinion is believed by Mr. Knight to be, in some cases, well founded. But as he is not acquainted with any advantages that can be obtained or derived from fecling flocks of a species different from that of the bud or graft inflected, except in cases where it is advisable to render any tree more dwarfish and governable in its manner of growing, and consequently more productive, in soils and situations where rapidity and exuberance of growth and health might prove injurious: it is indeed suspected, that the peach-tree might be budded upon its own flock, in many cases, with considerable advantage. The growth of the peach-tree, it is said, is so rapid under these circumstances, that, with the aid of artificial heat, the flock which is raised from a seed in the spring may be budding and headed down for the same season, and afford a crop to bear many peaches in the succeeding year; and for forcing-houses, where exuberance of growth may be effectually checked by a succession of heavy crops of fruit, the writer says he should prefer such trees to any others. The fruit which they afford in the first season has, however, been found to be inferior in flavour to that which older or trees of longer growth produce.

The following interesting circumstance is stated by Mr. Knight, in respect to the Moor Park apricot. In his garden, this tree, in many others, he says, becomes, in a very few years, diseased and debilitated, and generally exhibits, in spaces near the head of its stock, lifeless albunums, beneath a rough and scabrous bark. About sixteen or seventeen years ago, a single plant of this variety was, it is said, obtained by grafting upon an apricot stock; and that the bark of this tree still retains a smooth and polished surface; and the whole tree presents a degree of health and vigour, so perfectly different to any other tree of the same kind in his garden, that he has found it difficult to convince gardeners, who have seen it, of its specific identity.

It is hoped that this statement may induce the possessors of public nurseries to try the effect of flocks of different species, and particularly those of the apricot; for though it may be their interest that the trees they sell should perish, as they now generally do within a very few years, it cannot be supposed that the more responsible nurserymen would be influenced by such a consideration: besides, an additional price, which will, it is said, to some extent be necessary, if such a method should be had recourse to, will afford a fair compensation, should the number of trees on sale be in any way diminished.

Such a mode of raising and providing fruit-trees of several different kinds is certainly well worth being put to the trial, as it is of great consequence, in many cases, to have more lathing trees of such sorts than those which are at present employed in the ordinary practices of the garden.

STOCKS. Apple and Pear, for Field Fruit-groonds, in Rural Economy, the stocks which are made use of in raising and providing them with trees of these sorts, in different districts. Several kinds of stocks are employed in this instance, sometimes by way of having the branches or parts of suitable and proper trees of these kinds inflected into them, and at others as seedling-trees, without that being done, though the first mode is the most ready, and for the most
STOCKS.

most part had recourse to, especially in some districts. The pear is, however, the most advantageously raised on flocks of its own species, and lasts longer than the apple-tree.

Raising the Stocks.—In performing this, the fresh pulp of the apples affords a sufficiency of pips or kernels for the supply of the feed-bed; which, after it has been well prepared by digging and other means, has them somewhat thickly sown, or the pulp spread evenly upon it, either in the autumnal or spring leaon, and carefully raked or lightly harrowed in, so as to be well covered with the surface-mould: the latter of these season is, however, supposed to be the best and most fortunate, as there is the least danger of their being destroyed by mice and other vermin, which often greedily prey upon them during the winter months. All weeds are carefully prevented from rising during the ensuing summer-seaon; and in the second or third autumn, the young flocks are mostly ready to be put out into the nursery-ground. This is to be dug with the same care as the feed-bed; and at the time of the removal of the flocks or plants, the roots of them are to be pruned and refrained, by taking off the tap or down-dripping one, and shortening the others. They are then to be planted out in rows at three feet distance, and about eighteen inches from each other. In this method of planting them in the nursery-ground, 9522 flocks may be planted on the acre, or thereabouts. They remain in these grounds from eight to ten years, when they will mostly have attained sizes proper for being finally put out into the field fruit-gounds. While in the nursery-ground, they are kept regularly pruned and trained: the side-roots are cut off, and one neat upright stem preferred, with six or seven shoots regularly branching out each way at the head. In this state, the price for them was, some time ago, for the apple-flock 11 6d., and for those of the pear 21 6d.: consequently the profit of an acre of ground thus employed is very considerable: 9522 flocks, disposed of at the above prices, amount, it is laid, in the first cafe, to 714l.; in the latter, to 1190l. 5s.: and that after the third year, the profit may be reckoned on as near, since the occasional crops, raised in the void spaces and parts between the flocks, will pay the expenses of labour and rent.

In some districts, when the young flock plants are come up to the size of the proper flocks growing, they are planted in, the proper flocks of their ensuing growth, care is taken to select all such as produce the largest and most luxuriant leaves, as is from that character that the best expectations are formed for procuring the most profitable fruit in this view. The rejected plants or flocks are drawn out from time to time, and the preferred ones left, for the purpose of discovering their specific qualities. These, when approved of, which point is most commonly ascertained by the end of the fifth year from the time of sowing the pips, their heads being previously formed upon stumps of about five feet high, are removed to any eastern aspect, except that of the north-east; and on to the sloping sides of hills, where there is no stagnant moisture of any kind in the under soil, and are there, for the most part, planted finally out at the distances of from 25 to 30 feet apart, according to circumstances, as will be seen below.

In some districts, the flocks of these sorts of tree-plants are planted out finally sooner, or after they have had less growth, than in others; but they should never be put out in this way, until they are of sufficient strength and growth, as has been directed above.

Planting the Flocks out in the Fruit-Grounds.—As soon as the flocks have arrived at or attained the height and growth of six or seven feet, and are come about five inches in circumference, they are in a proper state for being planted out in these grounds. Where the land is in the state of grass, they are generally planted at the distance of from 8 or to 10 to 12 or 15 yards from each other, suitable openings being prepared for them in a proper manner. In Devonshire, where smaller distances are allowed, holes are previously made, in which are deposited road-scrapings or way-foils in the proportion of about two seams or horse-loads to each. Where the grounds are under the plough, the distances of planting are from 16 to 18 or more yards, with an interval of 20 and upwards, and opposite to each other in some places; in particular, the distance of the rows, however, depends greatly on the width of the ridges, as they are planted on the tops of these in most cases: if the ridges be small, every other one is omitted, in some places; and where the contrary is the case, as where they are wide, always managing so as that the last distance may be nearly preferred. In ardow land, the quincunx of planting the flocks is sometimes practised, in order that space may be gained for the spreading of the heads of the trees, as the distance allowed in such cases is less.

In the planting of the flocks in the village lands, advantage is supposed to arise not only from the manuring and keeping the mould loose over the roots of the flock plants, but from there being a considerable saving of expense in the articles of fencing and defending the plants. The young flocks or trees are to be protected and defended from external injuries of all kinds, until they have gained a considerable state of growth, and are become firm in the roots, and perfectly hard in the bark. There are different methods of effecting this, which will be noticed below.

Good flocks of these kinds are sometimes met with in the hedge-rows of fruit districts, and might, perhaps, be occasionally planted there with great utility and advantage.

In respect to the most proper time for planting out the flocks, though something may most probably depend upon the feaston and the nature of the soil, February is the most usual and probably the best, as a long series of drought is inimical to late planting, while severe frosts are not leas to that of the autumnal feaston. It is, however, much easier to protect the roots of the flocks during the winter, than to be continually watering them during the summer-seaon.

There is much less care also required in planting them out on light and loose soils, than on such as are of a heavy or of a clayey nature. In the former, it is sufficient to just dig out the holes deep enough to cover the roots perfectly, and to return the mould as it came out of them; but in the latter, the digging of holes is complete ruin to the flock plants, as the whole depth underneath the cultivated soil is so retentive as to form a sort of pool of flagrant water or moisture, and where they are even filled with good mould, it is impossible for the roots to extend themselves into the surrounding clay or clayey matter. The best practice is, therefore, probably, to take off the surface-turf to some depth in a circle of about four feet diameter, and to fill the under soil in a light manner; on this to place some good earth, and then to plant the flock, with another layer of good earth, covering the whole over with the sod or turf, generally laid upside down. The tap-roots of the flocks are to be previously cut off or shortened, and the fibres also to be pruned at the ends, when they are to be placed out in regular order, having some new earth blended and shook down among them. But before the planting, the flocks are to be headed down; or at least the branches are to be shortened to six or eight inches, to guard
STOCKS.

guard against the power of the wind, and throw the juices more into the Rems, by which the vigour of the stocks is increased. The newly planted stocks are then to be well guarded from being in any way injured by live-flock, or in any other manner, in some of the modes which are directed below.

In the filling up old fruit-grounds, or the replanting new ones on the same ground, it is considered a bad practice, in some districts, to plant the flock on the exact spot where the old tree stood; but it is otherwise, if a pear be planted where an apple grew before, especially in cafes where the surface and under soil has been well prepared by digging and properly manuring the ground.

Grafting the Stocks.—When the stocks have been three or four years planted out in the fruit-grounds, they are in a state ready for grafting, where that method is had recourse to in completing the trees. But though this mode, as being most expeditious, may have been the most frequently had recourse to, it has been supposed by some, that no method of performing the operation has yet been attempted, has been found fully adequate to the purpose. For the stocks that are inferted, in consequence of being taken from old trees, though they grow vigorously for a few years, on account of the strong growth of the stocks, they then often decay, decline, and degenerate, or run into all the infirmities of their parent trees. Of course, on this principle, the refoiring or renovation of the old fruits of these kinds would seem to be impracticable; as by the general laws of nature, each of the different beings ended with life, lives to propagate its kind, and after a time resigns its place to a successor. It has been observed, that the branch from which a twig is taken for this purpose, evidently partakes of the life of the tree to which it belongs; and that it is not less evident, that when part of a tree is detached, no new life is afforded to it, whether it be employed in this way, or placed in the ground to emit roots as a cutting; in this manner, a tree reared from a cutting, soon produces fruit in every respect similar to that of the tree from which it was taken. Also, that the habits of seedling trees are very essentially different, that their leaves are small and thin, and that the general habit changes gradually, assuming in an annual manner a more cultivated character; that if a stock for grafting with, be taken from a seedling tree of one or two years' growth, it will retain the character, and undergo the same annual change, as the seedling plant or tree from which it was procured, whatever may be the age of the stock into which it is inferted; and that it will remain unproductive of fruit or blossoms, until the seedling tree has acquired its proper age and maturity or state of production.

In support of these conclusions it has been stated, that a seedling walnut, grafted with part of the bearing branch of an old tree, produced blossoms at three years' growth; that the Spanish chestnut, under a similar process, blossomed in the year after it was grafted; and that the annual fecon or twig of a mulberry-tree thus grafted, yielded a plentiful crop of fruit, in proportion to its size, in the third year after the operation, and has continued to bear every year since. The grafts in these cafes must, it is thought, have carried the mature habits of the parent trees with them; and that, if they retain these habits, it may fairly be inferred, that they also retain the same progressive tendency to decay, diæsa, and destruction. The seeds of the fruit of the old trees should, therefore, probably be foun, and the strongest and most healthy plants selected and let aside for the purpose of cultivation, and this supply of grafts which are necessary.

In the work of grafting, the heads of the stocks are first taken off by means of a proper saw, and then rendered quite smooth by the use of a very sharp strong knife; the height of doing which depends much upon the fancy of the planter, but is mostly performed at about seven feet high. The rest of the operation is done in the usual manner, according to some of the modes commonly practiced in this fort of work, as either by the simple common method, that of the grown method, or the root and whip method. A new plan of the root kind has, in some districts, been lately had recourse to. In this, when the stocks have reached a proper age or state of growth for planting out, the ground is opened about them, and they are separated from the largest roots; of which, such are chosen as are of a sufficient size for clef-grafting, which method is to be preferred; and if the roots be inclining, they are raised to a perpendicular, without disturbing their extremities which are in the ground; the shoot, or scion is then inferted in the usual way, and rendered perfectly secure. The earth is then returned to them all round, and one bud, or at most, two, are left above the ground in order to guard against failure, which are mostly found to strike with extraordinary vigour. Where both succeed, the leaf promising is removed. The buds, which are covered with earth, show out into roots, so that when the trees are to be removed to their defined situations, they may be entirely separated from the original root on which they were grafted. Sufficient roots remain to the parent flock for the future support of it, and it may be planted elsewhere, for the purpose of either producing a fresh supply of roots for the same process, or for grafting in the fruit-grounds. It is flattened, that some trees, raised by grafts in this way, have become handsome ones eight feet high, and had fine fruit on them in the course of four years. That fix of the stocks, which had been separated from the roots, and deemed useless, on being replanted, had kernel-fruit upon them in the same length of time. This method is said to be the discovery of Dr. Cheffon of Gloucester.

In some places it is the practice, in performing this fort of work, to infert two shoots or scions, one in or on each side the head of the flock; but one is mostly sufficient to form a head large enough. With some, where two are inferted, it is the custom, however, to remove that which is the least promising, where both strike, in the ensuing spring, and with a sharp knife or chisel, to pare off the top of the flock in a sloping manner to the remaining graft, which prevents water from lodging, and the sap then becomes directed to and concentrated in a smaller compass. After this, the wounded part should be well guarded and protected, in order to promote the more speedy healing of it, and the whole graft be firmly and properly secured.

Where both the grafts are suffered to grow, the head of the tree, from becoming double, is not unfrequently separated, and the trunk rendered by strong blowing winds, or even by the weight of the branches alone.

In cafe the grafts do not strike or take, it is considered dangerous, if not fatal to the flock, to infert new scions or shoots until the third or fourth year. Where they do strike, it is but seldom that any further care is taken of them, until the trees begin to be productive of fruit. This fort of negligence is, however, highly improper and disadvantageous, as they ought to be carefully watched in regard to the progress of the shoots, and the removing and cutting off the fragging, irregular, and useless branches, as by these and other means, the interior of the trees may be prevented from becoming loaded and incrusted with a redundancy of wood. See Grafting.

Defending the Stocks.—These are to be well guarded, pro-

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ected, and defended, when newly planted, as well as in their growth afterwards; as they are very liable and much exposed to be rubbed, barked, and otherwise injured, in many cafes, by different flocks of live-flock, and in other ways. There are many different modes of accomplishing this; as by frames of wood differently formed and set up, by poles differently placed, and slips of strong board properly nailed upon them; by poles and rails differently contrived, and by various prickly and thorny substantions and plants twisted and tied round the flocks in different ways. But the best method is probably that of having three poles put in a fort of triangular manner about the tree or flock, so as to come within a small distance of each other at the bottom or root part, and to diverge considerably in their upward direction, and formed into a fort of frame by proper short crofs pieces being nailed against them at suitable distances apart. Though this requires more wood than some other modes, the coarser farts may answer the purpose very effectually. There are objections to many of these methods from the flocks and trees, when they begin to shoot freely, having their lateral branches rubbed greatly by them, and from the poles forming holes in the ground, by being agitated by the winds, into which the moisture is drawn from the roots of the focks or trees, as well as from other circumstances. The thorny matters are cheap methods, but they are readily removed by live-flock, by which means the bottom parts of the focks are liable to become naked and be rubbed by the sheep, which is very hurtful to them.

The trees raised and formed from focks in this way mostly come into bearing in from six to seven years after the grafting has been performed, but the quantity of fruit is seldom large for some length of time afterwards, then, however, it becomes considerable for a great number of years. See Apple Tree.

Stocks, Cippus, a wooden machine to put the legs of offenders in, for the securing of disorderly persons, and by the way of punishment in divers cafes ordained by statute, &c. And it is said that every vill within the precinct of a city is punishable for not having a pair of focks, and shall forfeit 5l.

Stocks, in Ship Carpentry, a frame erecled on the flore of a river or harbour, on which to build shipping. It generally consists of a number of wooden blocks, ranged parallel to each other, at convenient distances, and with a gradual declivity towards the water. See Launch.

Hence, we say, a flap is on the focks, when she is building. STOCKSE, in Geography, a town of the duchy of Holstein; 8 miles N. of Segeborg.

STOCKSTADT, a town of Germany, on the Main; 3 miles W. of Aachenburg.

STOCKSUND, a town of Norway, in the province of Drontheim; 60 miles N. of Drontheim.

STOCKTON-UPON-TEES, is a borough by prenotification in the south-west division of Stockton ward, and parifh of Stockton, in the county-palatine of Durham, England. The antiquity of this place may be readily inferred from giving its name to one of the county wards; but its origin is not ascertained. Stockton castle, on the north side of the town, was at one period inhabited by the bishops of Durham, who were appointed to govern the whole province committed to their care. This fertoft was on the northern bank of the river Tees, and commanded an extensive prospect over the valley and country. In the time of Charles I. it was garrisoned in behalf of the king; but afterwards fell into the power of the parliamentarians, who ordered it to be destroyed; which was so completely executed, that not a flone of the former edifice remains. The only vestiges are the moat, which defended the castle on three sides; and a barn, which appears to have flood within the area of the works. In the year 1252, Stockton was nearly destroyed by the Scots; but at the close of the civil wars it recovered its importance. The population, in 1725, amounted to 430 families; but in the reports of 1811, the inhabitants had increased to 4429, and the houses to 872.

Stockton consists of two parts; one, called the Borough, where all the land is freehold; and the other, denominated the Town, where it is copy or leasehold; the latter held under the vicar and vestrymen, and is not within the borough jurisdiction: for this reason there are two constables, with peculiar officers, though both form one parish. The civil government is vested in a mayor, alderman, and recorder, (who is alwayseward of the bishop's court-leet and baron,) besides inferior officers. The mayor is elected by a majority of the burgesses, yet it is not required that he should first have been an alderman. The situation of this town, on the northern banks of the Tees, at a convenient distance from the sea, renders it very favourable for commercial purposes: its maritime trade began to revive soon after the restoration, and the officers of the customs removed hither from Hartlepool in 1680, and lawful quays were erected in 1683. Below Stockton, the river flows in a very circuitous course; and as it approaches the German ocean, expands into a large bay, upwards of three miles in width. Stockton is probably the most handsome town in the north of England, as well for the breadth of its principal street, as the general neatness of its buildings. This street is about half a mile in length, and upwards of sixty yards broad at the market-place, which is in the centre; and this renders the entrance to the town, either from north or south, particularly impressive. Several smaller streets branch off in different directions; and at the north-east side is a spacious square, which contains some good buildings. The town hall, near the middle of the principal street, is a large square building, partly occupied as a tavern, and containing various elegant apartments, devoted to civil and other public purposes. At a short distance is a handsome old church, thirty-three feet high, of the Doric order, where the market is held; the site of which was formerly occupied by an open crofs.

Stockton was originally a chapelry to Norton, a peanfent village about two miles to the north, but was constituted a distinct parifh in the year 1711. During the episcopacy of bishop Poore, who died in 1234, a chapel of ease was erected here, which, upon becoming both ruinous and too small, was taken down, and a new church opened in August 1712. The church is a handsome brick building, with the doors and windows cafed with flone: its length, including the tower and chancel, is 150 feet; this tower is at the west end, and is 80 feet high. The vestry contains a collection of divinity, which is still increasing from donations and subscriptions. The various denominations of Presbyterians, Quakers, Methodists, and Roman Catholics, have each a meeting-house in this town; which also contains the public institutions of a grammar-school, charity-school, funday-school, and an alms-house, or hospital.

The manufactures of Stockton are fail-cloths and cordage, both of which are carried on to a great extent. The making of damalks, diapers, huckabacks, towelling, and checked linens, has likewise lately been executed in considerable perfection. Two docks for building ships are also situated on the banks of the Tees. An elegant bridge, with five arches, was erected over this river, towards the close of last century, at the expense of 8000l. The tolls on this bridge
bridge gradually augmenting, now let for 800L annually, which is appropriated to discharge the principal and interest already incurred; and when these are liquidated, the bridge will be free, and the future incidental charges be defrayed by the county of Durham, and the North Riding of Yorkshire, jointly. The shock of an earthquake was felt at Stockton in December 1780: and in August 1783, a violent fire, thunder and lightning took place, with a shower of irregular pieces of ice, some of which measured from three to five inches in circumference.

Stockton is the birth-place of Joseph Reed, a dramatic author, who was born in 1722: of Braf Crosby, esq. born in 1726, who rode from a very humble station in life to be lord mayor of London: Joseph Ritson, an eminent literary critic, was also a native of Stockton. See Ritson.

Near this town, on the river Tees, is a considerable salmon fishery; and at the mouth of the river is a fishery for cockles. About four miles north of Stockton is Winyard, the seat of sir Harry Vane Tempest, bart. The house, a hand-house, modern edifice, occupies the site of an old building, in a park which presents some interesting scenery.—Hilgery, &c. of Stockton-upon-Tees, by the Rev. J. Brewster, 4to. vol. v. Beauties of England, &c. Durham, by J. Britton and E. W. Braly.

STOCKUM, a town of Wiltphalia, in the bishopric of Olmbruck; 5 miles E.S.E. of Olmbruck. STODDARD, a township of America, in the state of New Hampshire, and county of Cheshire; about 15 or 18 miles E. of Walpole, on Connecticut river, containing 1132 inhabitants.

STODE, a town of Sweden, in Medelpadia; 18 miles W. of Sundvall.

STODGED, in Rural Economy, a term provincially signifying filed to the flitch, as the udder of a cow by milk.

STODHART BAY, in Geography, a bay on the N.W. coast of Jamaica.

STOEBE, in Botany, a name received by Pliny from the Greeks, which he says is synonymous with Pheum. If the latter be, as many have believed, our Typha, the use made of its downy feves, for stuffing cushions or beds, may account for the origin, or rather the application, of the name; roots in its primary sense appearing to have designated a plant used for burning, or for making what was, doublets, the most ancient and simple form of beds. The roots of Dioscorides however, merely mentioned by him as a well-known plant, useful for the alluring properties of its roots and leaves, is believed to be Parietaria spinosa, whose qualities answer to this description, and which is called in modern Greek ariph. How Linnaeus came to select the name of Stoebe for the genus before us, in his Hortus Cliffortianus, where, without any explanation, it is the first time appears in its works, we are at a loss to explain. The hard rigid African shrubs which compose it are, like the above Parietaria, of all things most unfit to make a bed, except for a rhenoceros or hippopotamus. He seems to have taken upon this name, for a new syndetogenic genus, because it had been variously applied by old botanists to certain compound flowers, and was then vacant, nor did he advert, in any manner, to its feve or etymology.—Linn. Hort. Cliff. 300.


Gen. Ch. Common Calyx roundish, imbricated; its scales awl-shaped, permanent, inveterating the common receptacle on all sides. Partial Perianth solitary within each scale of the common calyx, single-flowered, of five linear, acute, equal, erect leaves. Proper Cor. of one petal, funnel-shaped; its limb in five spreading segments. Stam. Filaments five, short, capillary; anthers united into a five-toothed cylinder. Fil. Germin oblong; style thread-shaped, the length of the flaments; stigma acute, divided. Peric. none, except the unchanged calyx. Seeds solitary, oblong. Down feathery, long. Proper Recept. naked.


Obst. Gaertner considers the common calyx as nothing else than, either the upper leaves of the plant, or the outer scales of the receptacle, while the partial calyx consists of the inner scales of the receptacle. According to this view of the subject, Stocke should be removed to the third, or discifol, fection of the order Polygama equalis, and we are much disposed to concur in that opinion.

The discoveries of Thunberg have greatly enriched this, as well as other Cape genera, so that Willdenow reckons up twenty species, about half of which are known to Linnaeus. But two or three of these really belong to Stoebe; Abutilon, abollished by Willdenow; see that article. About a dozen are natives of the south of Africa; one of the isles of Mauritius and Bourbon. Schizanthus, which has also a feathery seed-down, differs from Stocke in having only one flower in each outer calyx.

1. S. incana. Hoary Stoebe. Thunb. Prodr. 169. Willd. n. 1.—"Leaves sharp-pointed, thread-shaped, woolly."—Gathered by Thunberg at the Cape of Good Hope. We have seen no specimen.

2. S. aethiopica. Juniper-leaved Stoebe. Linn. Sp. Pl. 1315. Willd. n. 2. Ait. n. 1. Lamarck Illust. t. 722. f. 2.—Leaves awl-shaped, pointed, reflexed, keeled; polipithed on the under side. Stem erect.—Specimens of this plant were brought very early from the Cape; and Linnaeus foaming it in Clifford's herbarium, though not alive in his garden, founded hereinafter the genus of Stocke. Miller cultivated it in 1759, but no figure, except Lamarck's and Gaertner's, has ever appeared, Petiver's tab. 8. f. 1. being a different plant, as we shall mention hereafter. The stem is shrubby, of humble growth, with round leafy branches. Leaves crowded, almost imbricated, scarcely half an inch long, twilled, recurved, entire, concave, with a spinous point; fringed with long soft hairs towards the base. Flowers terminal, sessile, hemispherical, three-quarters of an inch in diameter. It is from this, the original species of the Hortus Cliffortianus, that the character and idea of the genus are taken.

3. S. ericoides. Heath-like Stoebe. Linn. Mant. 574. excluding the reference to Breynius and Morison. Willd. n. 3. Thunb. Prodr. 169. Berg. Cap. 339. (Eupateroideae capensis capitatus; Petiv. Gazoph. t. 8. f. 1.)—Leaves minutely pointed, linear, revolute, oblique, reflexed. Stem erect. Some ligulate florets. Native of the Cape. The stem is a spars high, determinately and repeatedly branched, twilled and leafy. Leaves about two lines long, spreading every way, oblong, with a minute point, roughish, with a few little differenced tubercles: hoary when young. Flowers round, sessile, terminal, pale red or flesh-coloured. Each partial calyx usually contains, along with its proper tubular perfect flower, another short ligulate neuter one. The seed-down is loosely feathery. Petiver's figure undoubtedly represents this plant very characteristically. That of Breynius,
STOEBE.

nus, erroneously quoted t. 9, instead of 69, by Linnaeus, is S. fufa, the leaves of which are less spreading.

4. S. prostrata. Prostrate Stoebe. Linn. Mant. 291. Wild. n. 4. Thunb. Prodr. 169.—Leaves pointed, lanceolate, oblique; woolly beneath. Stem decumbent.—Found at the Cape by Thunberg.—The stem is much branched, clothed with spreading, ovate-lanceolate, thyme-like leaves; green and smooth above; very white, with a concealed rib beneath. Flowers the size of a large pea, tawny or reddish, with very white anthers. Scales of the common calyx exactly like the leaves, in this as well as other species.

5. S. physicoides. Physic-leaved Stoebe. Thunb. Prodr. 169. Wild. n. 5.—"Leaves pointed, lanceolate, erect. Stem erect."—From the same country. Thunb. This definition is insufficient to give any distinct idea of the plant. We have seen no specimen.

6. S. gomphrenaoides. Amarantle Stoebe. Linn. Suppl. 391. Wild. n. 6. Berg. Cap. 336. Thunb. Prodr. 169. —"Houttuyn Linn. Pl. Synt. v. 4. 435. t. 34. f. 1."—Leaves elliptic-oblong, concave, fringed; woolly on the upper side; the lower ones minutely pointed.—Gathered by Thunberg at the Cape. The stems are numerous, erect, leafy, a foot high, much branched at the bottom. Leaves half an inch or more in length, imbricated; convex, green and somewhat silky, at the back, with a flabby marginal fringe. They are mostly obtuse, without any minute spiny point, except on the lower ones. Flowers round, white, rather polished, resembling the heads of a Gomphrena. Each flower appears to have a double calyx; the outer one short, coloured, and somewhat woolly; so that this species should seem rather to belong to Seriphium, as Linnaeus has marked it in his copy of Bergius.

7. S. gomphalooides. Cudweed Stoebe. Linn. Synt. Veg. ed. 13. 554. Wild. n. 7. Thunb. Prodr. 169. (Seriphium corymbiferum; Linn. Mant. 119. Gomphalium niveum; Linn. Sp. Pl. 1192. G. incanum, folio lineari cauli acuminato; Burn. Afric. 215. t. 77. f. 1, bad and incorrect.)—Leaves flat-pointed, ovato-lanceolate, concave; woolly on the upper side; polished at the back. Panicles cyme.—Gathered at the Cape by some of its earliest botanical visitors. The stem is shrubby, rigid; its upper branches leafy, woolly. Leaves erect, crowded, somewhat imbricated, half an inch long, pungent; smooth at the back and margin, curiously dotted, or reticulated. Flowers numerous, yellow, in dense, terminal, corymbose tufts; each flower cylindrical, with a tamarro, imbricated, tight, partly woolly, common calyx. Flowers two or three. Seed-down club-shaped, very shortly feathered. We cannot but conceive the genus of this plant to be very doubtful, the inner calyx being so finely distinguishable.

8. S. fucab. Rough-leaved Stoebe. Linn. Suppl. 391. Wild. n. 8. Thunb. Prodr. 170.—Leaves erect, linear; woolly above; imbricated at the back. Flowers racemose.—Found at the Cape by Thunberg. The minute carinated leaves, and outer calyx, are rough with glandular prickles. Flowers four or five. Their proper calyx is smooth, twice as long as the outer. Sometimes, but not always, the rough scales of the outer calyx surround and separate each particular flower, making the plant a true Seriphium; so nearly are these two genera related!

9. S. cinerea. Grey Heath-leaved Stoebe. Wild. n. 9. Thunb. Prodr. 169. Ait. n. 2. (Seriphium cinereum; Linn. Sp. Pl. 1316. Bryonia cineroides capensia; Petiv. Gazoph. t. 3. f. 9.)—Leaves spreading, linear; woolly above; smooth at the back. Flowers in dense whorled spikes. (See Seriphium, n. 1.) This appears however to be a true Stoebe. The common calyx has woolly obsolete scales, and contains many florets, whose partial calyx is smooth, with long bristly points, seeming to surround each floret distinctly.

10. S. fubulata. Aawl-leaved Stoebe. (Seriphium gna-phalodes; Linn. MSS.)—Leaves somewhat spreading, in-volute, pointed, aawl-shaped; woolly above; slightly mufi-cated at the back. Flowers spike. Outer calyx woolly;—Native of the Cape of Good Hope.—The stem is erect, woolly, branched, leafy, round, slightly woolly. Leaves at first erect, then spreading or recurved, hardly an inch long at most, very slender, and apparently thread-shaped, but they are concave and woolly above; the under side is clothed in a decidious filmy web, and armed here and there with prominent prickles. Spike terminal, short, ovate or oblong, rather compound, somewhat leafy. Common calyx very distinguishable from the leaves, with short, obtuse, partially woolly scales, containing two or three, rarely four, florets, whose partial calyx is long, pointed, and membranous, Seed-down loosely feathered. We cannot find that this plant has ever been published before.


14. S. plumata. Feathery Stoebe. Wild. n. 13. Thunb. Prodr. 169. (Breyenia capensis, capitulus albis plumatis; Petiv. Gazoph. t. 5. f. 4.)—See Seriphium, n. 2, where this species is properly placed, having but a solitary flower, whose long, smooth, prominent, partial calyx, projecting out of the woolly stern external calyx, is very remarkable. We cannot understand the observation in Linn. Mant. 481, "fiores 5, seve 6, flores," unless each scale of the inner calyx was taken for a floret.

15. S. fucata. Brown Stoebe. Wild. n. 14. Thunb. Prodr. 170. (Eupatorium ericoides, capitibus green; Breyen. Cent. t. 69. Abrotanoides capensis, erice folio; Petiv. Gazoph. t. 5. f. 2.)—See Seriphium, n. 3, to which genus this species undoubtedly belongs, each flower having a distinct outer, as well as inner, calyx, notwithstanding its great resemblance to Stoebe ericoides, n. 3.


17. S. aphyra. Harsh Stoebe. Thunb. ibid. Wild. n. 16.—"Leaves linear, pointless, smooth, reflexed. Flowers lateral."—This and the last were found by Thunberg at the Cape, and do not appear to be known by any other author.

Gathered by Commeron in the Isle of Bourbon. This is certainly a *Sphacelium*, not a *Stoea*. The stem is six or eight feet high, with innumerable branches, resembling a *Tamarix* in habit. *Leaves* minute, imbricated; smooth at the back. *Infra calyx* long and smooth, at length spreading widely. The outer is cylindrical, of many rounded imbricated scales, woolly within, and contains a single *flower* only. This should follow *Sphacelium fuscum* in its proper place. 4

19. *Rhincorucoris*. Rhinoceros Stoebe. Linn. Suppl. 591. Wild. n. 13. Thunb. Prodr. 170.-Leaves triangular-obovate, close-petioled. Branches downy, drooping. Clusters prolific.-Native of the Cape, and said to be the chief food of the rhinoceros. We have seen no specimen, but it is very possible, as Lamark supposes, that this may not be different from the last species.


21. *S. caerulea*. Snow-white Stoebe. Thunb. ibid. Wildl. n. 30.-Leaves triangular, obtuse, close-petioled. Flowers terminal.—In this view of the genus *Stoea*, as it stands in Wildenow, we have been chiefly solicitous to ascertain species and their synonyms. The intelligent reader may arrange some of them under this genus, others under *Sphacelium*; but the greater part must remain in uncertainty, either from the obscurity of Nature herself, in this very ambiguous cafe, or because we have not sufficient information from Thunberg, who alone has seen some of the species. The genera appear to us too distinct to be resolved into one. They require to be carefully studied by an adept, who ought to be possessed of all the known species of both, and to examine the structure of all their flowers, before he attempts to draw any conclusion respecting their generic distinctions, or even their precise place in the Linnean system.

STOECHADES, in Ancient Geography, islands of the Mediterranean sea, upon the coast of Oalia Narbonensis. These islands are the same with the islands of Hiera. Strabo mentions five of them; and three of these defer to be recorded, viz. Prote, Meta, and Iops. *Stoechades*, or the Leftier *Stoechades*, were two small islands of the five above-mentioned, situated opposite to Marseilleilles, called Ratoneu and Poméque.

STOECHAS, in Botany, *Sycos* of Dioscorides, appears very clearly, from his description, to be the *Lavandula Stoechas* of Linnaeus. (See *Lavandula*, n. 2.) The above ancient writer says it owes its name to the islands called *Stoechades*, on the coast of France, now called *Iles d'Hypere*, where it was known to grow.

STOECHAS is also the specific name of a *Gnaophiollum*, Linn. Sp. Pl. 1195. The *Sicilia* of old writers.

STOEFLER, JOHN, in Biography, a German mathematician, was born at Juttlingen, in Swabia, in 1452, and was raised from humble life into a reputable situation by his attainments. About the year 1483 he became professor of mathematics at Tubingen; and Philip Melanchthon and Sebastian Munster were his scholars. He improved geography, to which he was much attached, and constructed various maps; all which, with many MSS., were consumed by a fire which broke out in 1534. Being an industrious calculator, he computed ephemerides for many years; which were first published at Ulm in 1499, when they begin, and extend to 1531. At the latter year they commenced at Tubingen, and continued for twenty years, to 1552. He also constructed very neat mathematical instruments and globes. He composed likewise several useful works. Confiding in the reverence of judicial astrology, he is said to have predicted a general flood; which threw Europe into great alarm, so that universal terror prevailed. But when the year arrived, no inundation took place. Stoepler died at Baubraun in 1531. He was author of several astronomical works, besides the ephemerides; and he left in MS. a commentary on Ptolemy's Geography, preserved in the library of Ulm. Gen. Biog.

STOEK, in Geography, a river of Holstein, which runs into Elbe, 2 miles N.W. of Glückstadt.

STOECKELIA, in Botany, is one of those two famous genera, which Crantz, a severe critic of superior writers, made out of one single species, *Dracena Draco* of Linnaeus. For this he is held up to admiration in the *Synt. Veg.* under *Dracena*; the only vengeance which Linnaeus took, for his many petulant and unjust attacks; but it is conclusive.

STOF, in Commerce, a liquid measure at Dantzig, Riga, &c. See Tab. XXXII. under MEASURES.

STOGUMBER, or Storke-Gomer, in Geography, a market-town in the hundred of Williton and Freemansmore, and county of Somerset, England, is seated in a valley to the south-west of the Quantock hills, near the northern side of the county, and consists chiefly of two streets. A large church, dedicated to St. Mary, contains a nave, chancel, two aisles, and as many chapels; the south aisle is surrounded by an embattled tower, seventy-two feet in height. On the south side of the chancel is a tomb, with the effigy of Sir George Sydenham, and in the church-yard is an ancient stone cross. This town is endowed with one annual fair, and a weekly market on Saturday; its population in 1811, was 1214 inhabitants, who occupied 224 houses. About two miles from the church of Stogumber, are the remains of Combe Sydenham, the ancient mansion of the family of that name. Some of the old staircases are yet tolerably entire, as well as the kitchen, which appears to have been very large; and near the centre of the building is a tower. The parish of Stogumber contains an almshouse, founded by one of the Sydenham family, with a provision for it from their estate. There is also a charity of thirteen pounds per annum to the poor for ever. In this town and its vicinity, many Roman coins have been found, together with other antiquities of the same people. The adjoining parish of Bicknoller is supposed to have derived its name from two British words, signifying a small treasury, in allusion to the quantity of specie there discovered. On an eminence near the church, in the same parish, are the remains of an ancient fortification, called Tredle castle, the fosse and entrance of which still remain. We find from this, on the summit of the same hill, is another, of much smaller dimensions, called Turk's cattle; and near this spot is a beacon, which has an extensive and commanding view of the whole country. The parish of Strington, on the opposite side of the Quantock hills, contains a large intrenchment, called Doucourage castle, of a regular form, consisting of a double rampart, with a very wide and deep fosse. The church of this parish is a small building, having a nave, chancel, and an aisle or chapel: the church-yard contains an ancient stone cross. History, &c. of Somersetshire, by the REV. J. Collinson, 4to. 1791, vol. III.

STOJANOW, a town of Poland, in Volhynia; 44 miles S.W. of Lucco.

STOCAL FATE. See FATE.

STOICISM, the doctrines and opinions of Zeno's followers, called Stoics.

STOICS, a sect of ancient philosophers, the followers of
of Zeno; thus called from the Greek ὁ πόρτιος, or the porch; because the place which Zeno chose for his school was the "Porch," or painted porch, a public portico so denominated from the pictures of Polygnotus and other eminent painters, with which it was adorned. This portico, which was the most famous in Athens, was called τοῦ πορτίου, the porch.

The porchar of this sect, Zeno, was a native of Cittium, a maritime town in Cyprus, originally peopled by a colony of Phenicians, whence he is sometimes called a Phenician, and is supposed to have borrowed many of his dogmata from Phenician philosophy, which many learned men maintain was, itself, borrowed from the Jews; though it must be allowed, there appear as many things in the Stoic philosophy, borrowed from Plato's and Socrates's school, as from that of Moises. The profession of his father was that of a merchant; but his son, manifesting an early propensity towards literature, he early devoted him to philosophy. The father, having frequent occasions, in his mercantile capacity, to visit Athens, purchased for his son several of the works of the most eminent Stoic philosophers. These he read with great avidity; and when he was about thirty years of age, he determined to take a voyage to a city, which was so celebrated as a mart both of trade and of science. What were his views in this voyage, whether mercantile or scientific, is not certain. Some writers report, that he made a trading voyage from Cittium to Athens, richly freighted with Tyrian purple, and was shipwrecked not far from port; upon which he was told, consulting the oracle how he should spend the rest of his life, he was answered, ποιείν δεξία των νεκρών, by becoming of the same colour with the dead; upon which he applied himself to the study of the ancient philosophers, and became a hearer of Crates, the Cynic.

Others relate, that upon his first arrival in Athens, he went accidentally into the shop of a bookseller, and taking up a volume of the Commentaries of Xenophon, read a few passages, and that, being highly gratified by the perusal, and forming every favourable opinion of the author, he asked the bookseller where he might meet with such men. Crates, the Cynic philosopher, passed by the shop at this moment, and the bookseller pointing to him, said to Zeno, "follow that man." Availing himself of an early opportunity of attending upon the instructions of Crates, he enlivened himself in the number of his disciples. But highly as he admired the general principles and spirit of the Cynic school, he could not reconcile himself to their peculiar manners; and, besides, his inquisitive disposition would not allow him to imbibe that indifference to every scientific enquiry which formed one of the distinguishing characteristics of that sect. Abandoning Crates, he repaired to the school of Stilpo; and when his former master attempted to drag him away from it by force, he said to him, "you may seize my body, but Stilpo has hold of my mind." Having for several years attended upon the lectures of Stilpo, he had recourse to other schools, particularly those of Xenocrates, Diocorus Cronus, by whom he was instructed in dialectics, and on whom he conferred a large pecuniary gratuity for the discovery of some of his ingenious subtleties, and various other matters; and at length he offered himself as a disciple of Polemo. Polemo, however, apprized that Zeno, by removing from one school to another, was merely collecting materials to form a new system of his own, when he came to his school, said to him, "I am no stranger, Zeno, to your Phenician arts; I perceive that it is your design to creep sily into my garden, and to steal away my fruit." Polemo was not mistaken in his conjecture; for Zeno, after having made himself thoroughly acquainted with the tenets of others, determined to become the founder of a new sect, and established a school at Athens. Zeno was distinguished by that kind of subtle reasoning, which was at the period in which he flourished popular. He likewise exemplified the system of moral doctrine which he taught in his own life. We need not wonder, then, that he should attract a number of followers, and also enjoy the favour of the great. His lectures were attended by Antigonus Gonatas, king of Macedon, whilst he resided at Athens; and upon his return, Zeno was invited to his court. So highly was he esteemed among the Athenians, on account of his approved integrity, that they deposited the keys of their citadel in his hands. They also honoured him with a golden crown, and a statua of brasil. Among his countrymen, the inhabitants of Cyprus, and among the Sidonians, from whom his family was derived, he was likewise highly esteemed.

In his person, Zeno was tall and flender; his aspect was severe, and his brow contracted. His constitution was feeble; but he preferred his health by great abstemiousness. The supplies of his table consisted of figs, bread, and honey; notwithstanding which, he was frequently honoured with the company of great men. It was a singular proof of his moderation, mixed, indeed, with that high spirit of independence which afterwards distinguished his sect, that when Demochares, son of Laches, offered to procure him some gratuity from Antigonus, he was so offended, that from that time he declined all intercourse with him. In public company, to avoid every appearance of an assuming temper, he commonly took the lowest place. Indeed, so great was his modesty, that he seldom chose to mingle with a crowd, or with the company of more than two or three friends at once. He paid more attention to neatness and decorum in external appearance, than the Cynic philosophers. In his dress indeed he was plain, and in all his expenses frugal; but this is not to be imputed to avarice, but to a contempt of external magnificence. He shewed as much respect to the poor as to the rich; and conversed freely with perfons of the meanest occupation. He had only one servant, or, according to Seneca, none.

Honoured and esteemed as Zeno was by a great number of perfons, and unassuming and irreproachable as were his manners, he had his enemies. Philosophers of distinguished ability and eloquence employed their talents against him. Amongst these we may reckon Arcellaus and Carneades, the founders of the Middle and New Academy. Towards the close of his life, Epicurus, whose temper and doctrines were alike inimical to the severe gravity and philosophical pride of the Stoical sect, was his powerful adversary. Zeno is said to have lived to the extreme age of 98 years, and at last, in consequence of an accident, voluntarily put an end to his life. In walking out of his school, he fell, and broke one of his fingers; upon which, he was so affected with a consciousness of infirmity, that, striking the earth, he said, "Why am I thus importuned? I obey thy summons!" and immediately going home, he strangled himself. He died in the first year of the 135th Olympiad, B. C. 264. The Athenians, at the request of Antigonus, erected a monument to his memory in the Ceramicum.

If we compare the doctrines of Zeno with the history of his life, his heterogeneous system will appear to have been compiled out of the various tenets of the schools which he frequented; and on the credit of these he assumed to himself the title of the founder of a new sect, which spread widely, and subfitted for many ages. Of Zeno, Cicero says, that he had little reason for deferring his matters, especially those of the Platonic school, and that he was not so much
much an inventor of new opinions as of new terms. A comic poet, quoted by Athenaeus, thus ridicules the logomachies of Zeno and his followers:

\[\text{Ἀκούει ὁ Στοικὸς ὑπὸνομός κλήμ \n\text{Δόξας ἐνυπεραίως.}}\]

"Ye fages of the Porch, loquacious tribe, Traders in trites, arbiters of words, And censure! hear!"²

Zeno transferred the dialectics of Diodorus Cronus, and the moral doctrine of the Cynic sect, into his own system; the principal difference between the Cynics and Stoics consisting in this particular, that the former did maintain the cultivation of nature, and the latter affected to rise above it.

On the subject of physics, Zeno received his doctrine from Pythagoras and Heraclitus, through the channel of the Platonic school. Cicero censures the Stoics for encouraging in their schools a barren kind of disputations, and employing themselves in determining trifling questions, in which the disputants can have no interest, and which, at the close, leave them neither wiser nor better. And that this censure is not, as some modern advocates for Stoicism have maintained, a mere calumny, but grounded upon fact, sufficiently appears from what is laid by the ancients, particularly by Sextus Empiricus, concerning the logic of the Stoics. Seneca, who was himself a Stoic, candidly acknowledges this.

The Stoics, whose ruling passion was vanity, were ambitious of that kind of reputation which was derived from skill in the arts of reasoning and sophistry. The moral part of their philosophy partook also of the defects of its origin. It may be as justly objected against the Stoics as the Cynics, that they assumed a artificial severity of manners, and a tone of virtue above the condition of man. Their doctrine of moral wisdom was an oftentimes display of words, in which little regard was paid to nature and reason. It professed to raise human nature to a degree of perfection before unknown; but its real effect was merely to amuse the ear, and captivate the fancy, with fictions which can never be realized. Lastly, the physical and theoretical system of the Stoics, like those from which it had been borrowed, had, in its principles, a strong bias towards enthusiasm.

The extravagancies and absurdities of the Stoical philosophy may in some measure be ascribed to the vehement contentions which subsisted between Zeno and the Academic schools on the one hand, and between him and Epicurus on the other. Whilst Epicurus taught his followers to seek happiness in tranquillity, or a freedom from labour and pain, Zeno imagined his wise man not only free from all fons of pleasure, but void of all passions and emotions, and capable of being happy in the midst of torture. That he might avoid the torpid indolence of the Epicureans, he had recourse to a moral institution, which bore indeed the lofty front of wisdom, but which was elevated far above the condition and powers of human nature.

The natural disposition of Zeno, and his manner of life, had no inconceivable influence in fixing the peculiar character of his philosophy. By nature severe and morose, and constitutionally inclined to reserve and melancholy, he cherished this habit at an early period, by submitting to the austere and rigid discipline of the Cynics. Qualities which he conceived to contribute to his own personal merit, he transferred to his imaginary character of a wise or perfect man. His followers, therefore, affected an appearance of gravity and dignity, which they supported more by external show than by the real practice of sublime or useful virtues. Hence many of them were philosophers in words, rather than in their actions; and thus it was that their adversaries found so much scope for satirical ridicule and invective against Stoical pride and hypocrisy. Indeed, a system of philosophy, which aims at raising men above their nature, must commonly produce, either wretched fanatics or artful hypocrites. It is no proof of the perfection which some have been willing to ascribe to the Stoic philosophy, that there were among its professors many persons highly distinguished by genuine wisdom and virtue. For their uncommon merit was rather the effect of a happy temperament, or of fortunate circumstances in concurrence with those moral principles which are common to all mankind, than to the peculiarities of the Stoical system, which, as we shall presently see, were not adapted to cherish the genuine sentiments either of virtue or piety.

In forming an accurate judgment of the Stoical philosophy, it is necessary to guard against two errors into which we have been betrayed who have appreciated it too highly. We should not form our opinion of this philosophy from words and sentiments detached from the general system, but consider them in their connection both with the premises and conclusions; nor should we confound the genuine doctrines of Zeno, and other ancient fathers of this sect, with the glosses, or improvements, of the later Stoics; who, after the introduction of the Christian doctrine, artfully accommodated their language, and even their tenets, as far as possible, to the Christian model. (See Fatsa and Brucker, in his "History of Philosophy," translated by Enfield, has given an abstract of the Stoic philosophy, deduced from the writings of Cicero, Plutarch, Laerlius, Sextus Empiricus, Simplicius, and Stobaeus, compared with those of Seneca, Antonius, and Epictetus, under the different heads of philosophy in general, logic, physics, metaphysics, and morals. Our limits will only admit a few extracts. The doctrine of the Stoics, with regard to "philosophy in general," was, that wisdom consists in the knowledge of things divine and human; that philosophy is such an exercise of the mind as produces wisdom, and that in this exercise consists the nature of virtue; and consequently, that virtue is a term of extensive meaning, comprehending the right employment of the mind in reasoning, in the study of nature, or in morals. With Socrates and the Cynics, Zeno reprented virtue as the only true wisdom; but being disposed to extend the pursuits of his wife man into the regions of speculation and science, he gave, in his usual manner, a new signification to an old term, and comprehended the exercise of the understanding in the search of truth, as well as the government of the appetites and passions, under the general term Virtue. "Logic," according to the Stoics, is either rhetorical or dialectic; the former being the art of reasoning and discourse on subjects which require diffuse declamation, and the latter being the art of close argumentation, in the form of disputations or dialogue. Rhetoric is of three kinds, deliberative, judicial, and demonstrative. The dialectic art is the instrument of knowledge, by enabling a man to distinguish truth from error, and certainty from bare probability; and it considers things as expressed by words, and words themselves. External things are perceived by a certain impression made either upon the external parts of the brain, or upon the percipient faculty, which may be called an image, ἑιμαρτικός, since it is impressed upon the mind, like the image of a seal upon wax. This image is commonly accompanied with a belief of the reality of the thing perceived; but not necessarily, since it does not accompany every image, but those only which are not attended with any evidence of deception. Where only the image is perceived by itself, the
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thing is apprehensible; where it is acknowledged and approved as the image of some real thing, the impression is called apprehension, ἀνακατάληψις, because the object is apprehended by the mind, as a body is grasped by the hand. Such apprehension, if it will bear the examination of reason, is knowledge; if it is not examined, it is mere opinion; if it will not bear this examination, it is unsatisfactory.

The senses, corrected by reason, give a faithful report; not by affording a perfect apprehension of the entire nature of things, but by leaving no room to doubt of their reality. Nature has furnished us with these apprehensions, as the elements of knowledge, whence further conceptions are raised in the mind, and a way is opened for the investigations of reason.

Some images are sensible, or received immediately through the senses; others rational, which are perceived only in the mind. These latter are called in our, notions or ideas. Some images are probable, to which the mind affords without hesitation; others improbable, to which it does not readily assent; and others doubtful, where it is not entirely perceived, whether they are true or false. True images are those which arise from things really existing, and agree with them. False images, or phantoms, are immediately derived from no real object. Images are apprehended by immediate perception, through the senses, as when we see a man; consequentially, by likeness, as when from a portrait we apprehend the original; by composition, as when, by compounding a horse and man, we acquire the image of a Centaur; by augmentation, as in the image of a Cyclops; or by diminution, as in that of a pigmy.

Judgment is employed either in determining concerning particular things, or concerning general propositions, using in the latter case our preconceptions, or universal principles, as criteria or measures of judgment. The first impressions from the senses produce in the mind an involuntary emotion; but a wise man deliberately examines them, and suspends his assent or approbation (ἐνανθίωντος) with regard to the report of the senses, till he has investigated the nature of things, and fully estimated the weight of evidence.

The mind of man is originally like a blank leaf, but capable of receiving any impressions. These impressions, made by the senses, remain in the memory, after the objects that occasioned them are removed; a succession of these continued impressions, made by similar objects, produces experience; and hence arise permanent notions, opinions, and knowledge. Even universal principles, ἡ μὲν τῆς σοφίας, are originally formed by experience, from sensible images. All men agree in their common notions or preconceptions; disputes only arise concerning the application of these to particular cases.

These three things are mutually related; the expression, the notion or image in the mind which is expressed, and the external object. Under the head of expression, dialeitcs consider vocal sound, as expressed by letters; the several parts of speech; the etymology; analogy, or anomaly of syntax; the significations of words, and other properties of language. The notion or image expressed is the ὑμνήμα, phantazy, already explained.

Dialeitcs consider things as capable of being classed under species and genera. The most comprehensive genus is that which includes all things, both real and imaginary. Of things there are four subdivisions, viz. substance, qualities, modes, and relations. Things considered with respect to speech are said to be ἀλήθες, capable of being expressed in words. Predicates are things predicated, or declared, concerning another. Hence arise axioms, syllogism, and compound, and these admit of different characters. An argument (ἀγγείο) commonly consists of a general truth admitted (ἀφήμα); a particular cause (ὑπόθεσις); and a conclusion (ἐπισήμα). Arguments admit of different forms.

According to the Stoical doctrine concerning "nature," there existed from eternity a dark confused chaos, in which were contained the first principles of all future beings; which chaos, being at length arranged, and emerging into variable forms, became the world, as it now subsists. The universe, though one whole, contains two principles, distinct from elements; one passive, which is pure matter, without qualities, and the other active, which is reason or God. Zeno, determining to innovate upon the doctrine of the Academy, and declining to adopt the Dualistic system, which held God and matter to be two principles, eternally opposite, not only differing in their essence, but having no common principle by which they can be united, and also the emanative system (see Emanation) embraced a third hypothesis, which is distinguished by the appellation of the "Stoical system." Unwilling to admit, on the one hand, two opposite principles, both primary and independent, and both absolute and infinite; or, on the other, to suppose matter, which is in its nature diametrically opposed to that of God, the active efficient cause, to have been derived by emanation from him; yet finding himself wholly unable to derive these two principles from any common source, he concluded that the matter and the active principle were so essentially united, that their nature was one and the same.

The Stoical system teaches, that both the active and passive principles in nature are corporeal, since whatever acts or suffers must be so. The efficient cause, or God, is pure ether, or fire, inhabiting the exterior surface of the heavens, where every thing which is divine is placed. This ethereal substance, or divine fire, comprehends all the vital principles by which individual beings are necessarily produced, and contains the forms of things, which, from the highest regions of the universe, are diffused through every other part of nature.

Matter, or the passive principle, in the Stoical system, is definitive of all qualities, but ready to receive any form; inactive, and without motion, unless moved by some external cause. The contrary principle, or the ethereal operative fire, being active, and capable of producing all things from matter, with consummate skill, according to the forms which it contains, although in its nature corporeal, considered in opposition to gross and flimsy matter, or to the elements, is said to be immaterial and spiritual.

Some persons have been misled in forming their notions of the Stoical system, by the bold innovations of its advocates in the use of terms; and accordingly they have inferred from the apppellations sometimes applied by the Stoics to the Deity, that they conceived him to be strictly and properly incorporeal. Whereas the truth seems to be, that, as they sometimes spoke of the soul of man, a portion of the divinity, as an exceedingly rare and subtle body, ψυχή καρπουτίου καὶ λειτουργίας, and sometimes as a warm or fiery spirit, κόρα με καιρόμενη, so they spoke of the Deity as corporeal, considered as distinct from the incorporeal vacuum, or infinite space, but as spiritual, considered in opposition to gross and inactive matter. They taught, indeed, that God is indestructible, incorruptible, and eternal; puffed with intelligence; good and perfect; the efficient cause of all the peculiar qualities or forms of things; and the constant preferver and governor of the world; and they described the Deity under many noble images, and in the most elevated language. The hymn of Cleanthes, in particular, is justly admired for the grandeur of its sentiments, and the sublimity of its diction. But if, in reading these descriptions, we habitually associate with them modern conceptions of Deity, and neglect to rec-
unto the leading principles of the sect, we shall be led into fundamental misapprehensions of the true doctrine of Stoicism. For, according to this sect, God and matter are alike unuced and eternal, and God is the former of the universe in no other sense, than as he has been the necessary efficient cause, by which motion and form have been impressed upon matter. What unworthy notions the Stoics entertained of God, sufficiently appears from the single opinion of his finite nature, an opinion which necessarily followed, from the notion that he is only a part of a spherical, and therefore a finite universe.

With respect to the doctrine of divine Providence, it appears that, according to the Stoics, the agency of the Deity is nothing more than the active motion of a celestial ether, or fire, possefled of intelligence, which at first gave form to the shapeless mass of gross matter, and being always essentially united to the visible world, by the fame necessary agency, preserves its order and harmony. The Stoic idea of Providence is, not that of an infinitely wise and good being, wholly independent of matter, freely directing and governing all things, but that of a necessary chain of causes and effects, arising from the action of a power, which is itself a part of the machine which it regulates, and which, equally with that machine, is subject to the immutable law of necessity. Providence, in the Stoic creed, is only another name for absolute necessity, or fate, to which God and matter, or the universe, which consists of both, is immutably subject.

The rational, efficient, and active principle in nature, the Stoics called by various names; nature, fate, fortune, God. "What is nature," says Seneca, "but God; the divine reason, inherent in the whole universe, and in all its parts; or you may call him, if you please, the author of all things." And again: "Whatever appellations imply celestial power and energy, may be justly applied to God; his names may properly be as numerous as his offices." The term nature, when it is at all distinguished in the Stoic system from God, denotes, not a separate agent, but that order of things which is necessarily produced by his perpetually agency.

The universe, according to Zeno and his followers, is a vast, infinite, immortal, inviolable, and animated being." But Zeno understood this doctrine in a sense different from that in which it was conceived by many former philosophers. Zeno, adopting the ideas of Pythagoras and Heraclitus, and assuming that there is no real existence which is not corporeal, conceived nature to be one whole, consisting of a subtle ether and gross matter, the former the active, the latter the passive principle, as essentially united as the soul and body of man; and supposing God, with respect to nature, to be, not a co-existing but an informing principle. Whilst the Stoics allowed that the Deity is the efficient and intelligent cause of all the effects which are produced in the world, their notions of his nature and attributes were confused and degrading. Refusing primarily in the superior celestial region, and being thence diffused, as a subtle fire through a finite world, his universal prehension is limited, and falls far short of the attribute of immensity, as it belongs to the divine nature. United to matter by the immutable chain of necessity, he wants that freedom of action which appears to be one of the most essential characters of the Supreme Being. The original communication, and the perpetual preservation of forms and qualities, by the necessary action of a subtle fire upon matter, though this principle be supposed to be possefled of reason and intelligence as well as energy, is certainly an idea of Deity, which falls far short of that pure and sublime doctrine, which represents God as creating and governing the world by voluntary agency, and with wise design. That

the Deity is, according to the Stoic doctrine, subject to the law of necessity no less than matter and all subordinate beings, Seneca, and other writers of this sect, expressly assert. "Both gods and men are bound," says he, "by the same chain of necessity. Divine and human affairs are alike borne along in an irreifiable current; cause depends upon cause; effects arise in a long succession; nothing happens by chance; but everything comes to pass in the established order of nature."

Portions of the ethereal soul of the world being distributed throughout all the parts of the universe, and animating all bodies, hence arise, in the system of the Stoics, inferior gods or demons, with which all nature is peopled. All these divinities they considered as derived from the soul of nature, and as limited in their duration. Demons were divided by the Stoics into superior and inferior; the superior, those which inhabited the sun and stars, which they considered as gods; the inferior, animated substances; the inferior, inferior, human souls separated from the body, or heroes. "Illustrious men," says Cicero, "whole souls survive and enjoy immortality, are justly esteemed to be gods, since they are of an excellent and immortal nature." Beside this, there seems little reason to doubt, that the Stoics acknowledged the existence of other inferior divinities, portions of the soul of the world, and taught that they are endowed with human passions, and therefore are proper objects of sacrifice and worship.

As the Stoics held, that all the inferior divinities are portions separated from the soul of the world, to the conception, that a period would arrive, when they would return into the first celestial fire, and supposing that, at the same time, the whole visible world would be consumed in one general conflagration.

On the subject of the origin of evil, they had recourse to fate, and taught that evil was the necessary consequence of that eternal necessity, to which the great whole, comprehending both God and matter, is subject.

Concerning the second principle in the universe, matter, and concerning the visible world, the doctrine of the Stoics is briefly this: matter is the first essence of all things, destitute of, but capable of receiving, qualities. Considered universally, it is an eternal whole, which neither increases nor decreases. Considered with respect to its parts, it is capable of increase and diminution, of collision and separation, and is perpetually changing. Bodies are continually tending towards dissolution; matter always remains the same. Matter is not infinite but finite, being circumscribed by the limits of the world; but its parts are infinitely divisible.

The world is spherical in its form, and is surrounded by an infinite vacuum. The action of the divine nature upon matter, first produced the element of moisture, and then the other elements, fire, air, and earth, of which all bodies are composed. Air and fire have essential levity, or tend towards the exterior surface of the world; earth and water have essential gravity, or tend towards the centre. All the elements are capable of reciprocal conversion; air passing into fire or into water; earth into air and water; but there is this essential difference among the elements, that fire and air have within themselves a principle of motion, while water and earth are merely passive.

The sun is a sphere larger than the earth, consisting of fire of the purest kind: it is therefore an animated being, and the first of the derived divinities. The stars too are of the same kind, fiery bodies endowed with perception and intelligence, and therefore to be ranked among the gods. They are nourished by exhalations from the seas and rivers.
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rivers. Because the heavenly bodies are animated, they are capable of foreseeing future events, and of declaring to mankind, by certain signs, the appointments of fate.

The celestial bodies move in their orbits, in the following order: Saturn, Jupiter, Mars, Mercury, Venus, the Sun, the Moon. The moon, which occupies the lowest part of the ethereal region, is, like the rest, a fiery luminous physion of intelligence; but the fire is mixed with air; whence the spots upon its surface. Its form is spherical, and its motion spiral, and of two kinds: the one, from east to west, with the heavens; the other from west to east, through the signs of the zodiac.

Below the sphere of the moon is the region of the air. This earth is the most dense part of the world, and is the main support of nature, like the bones of an animated body. The earth, with its waters, forms a globe, which is the centre of the world; it always remains immoveable.

The world, including the whole of nature, God, and matter, subject to eternity, and will for ever subsist; but the present regular frame of nature had a beginning, and will have an end. The parts tend towards a disgregation, but the whole remains immutably the same. The world is liable to destruction from the prevalence of moisture, or of dryness; the former producing an universal conflagration, the latter an universal conflagration. These succeed each other in nature as regularly as winter and summer. When the universal inundation takes place, the whole surface of the earth is covered with water, and all animal life is destroyed; after which, nature is renewed, and subsists as before, till the element of fire, becoming prevalent in its turn, dries up all the moisture, converts every substance into its own nature, and at last, by an universal conflagration, reduces the world to its pristine state. At this period, all material forms are lost in one chaotic mass; all animated nature is re-united to the Deity, and nature again exists in its original form, as one whole, consisting of God and matter. From this chaotic state, however, it again emerges, by the energy of the efficient principle, and gods and men, and all the forms of regulated nature, are renewed, to be dissolved and renewed in endless succession.

As a necessary consequence of the doctrine of the conflagration, and subsequent restoration of all things, the Stoics maintained, that the human race will return to life. Hence it appears in what sense we are to understand the Stoic simile of the sun, which rises again after an universal conflagration, the written with so much elegance; and what meaning we are to annex to his words, when he says, "Death, of which we are so much afraid, and which we are so fear to avoid, is only the interruption, not the destruction, of our existence; the day will come which will restore us to life." This tenet is not to be confounded with the Christian doctrine of the resurrextion of the body; for, according to the Stoics, men return to life, not by the voluntary appointment of a wise and merciful God, but by the law of fate, and are not renewed for the enjoyment of a better and happier condition; but drawn back into their former state of imperfection and misery.

Man, according to the Stoics, is an image of the world; one whole, composed of body and mind. The mind of man is a spark of that divine fire which is the soul of the world. The human soul, being a portion of the Deity, is of the same nature; a subtle fiery substance, endued with intelligence and reason; but the energy of this principle is confined and retrained, in the birth of man, by the union with groser matter.

Concerning the duration of the soul of man, the Stoics entertained very different opinions. Cleanthes thought that all souls would remain till the final conflagration. Chrysippus was of opinion, that this would only be the lot of the wise and good; and Seneca seems to have entertained the same notion. Epicurus and Antoninus affirmed, that as soon as the soul is released from the body, it returns to the soul of the world, or is lost in the universal principle of fire. Some were so absurd as to believe, that the human soul, consisting of a fiery spirit condened by its union with air, is capable of being extinguished. While others, with equal absurdity, conceived that the human soul, shut up within the gross body, could not, at death, find a free passage, but remained with the body till it was entirely deprived of life. The only idea of the preservation of the soul, which seems to have been entertained by the Stoics, was that of a renovation of being, in that fated circuit of things which we have seen to be one of their fundamental doctrines. In the universal restoration of nature, some imagined that each individual would return to its former body; while others conceived, that after a revolution of the great year, similar souls would be placed in similar bodies.

The soul, conceived by the Stoics to have been material, was represented by them as consisting of eight distinct parts, viz., the five senses, the productive faculty, the power of speech, and the ruling part, or reason. Those who held the existence of the soul after death, supposed it to be removed into the celestial regions of the gods, where it remains, till, at the general conflagration, all souls, both human and divine, shall be lost in the Deity. But many supposed, that before they were admitted among the deities, they must purge away their inherent vices and imperfections, by a temporary residence in the aerial region between the earth and the moon, or in the moon itself. With respect to depraved and ignoble souls, it was a common opinion, that after death they were degraded into the lowest state of the air, till the fiery parts were separated from the groser, and rose by their natural levity to the orbit of the moon, where they were still further purified and refined: a kind of mechanical purgatory, which very well agreed with the mechanical principles of the Stoic philosophy. These fancies are treated with ridicule by Epictetus and Seneca, who frequently speak of the happiness of good men after death in terms which might have suited a better system. Seneca, confounding Marcion under the lips of his son, says, "The happy assembly of the Stoics, which is not the Deity, but ourselves, who have themselves profaned life, and obtained freedom by death, shall welcome the youth to the region of happy souls. Your father himself (for all are there known to all) shall embrace his grandson, and shall direct his eyes, now furnished with new light, along the courses of the neighbouring stars, with delight explaining to him the mysteries of nature, not from conjecture, but from certain knowledge. Like a welcome guide in an unknown city, he will unfold to the inquiring stranger the causes of the celestial appearances."

The Stoic doctrine of "Mora" is founded on the principles of physics. Conceiving God to be the principal part of nature, by whole energy all bodies are formed, moved, and arranged, and human reason to be a portion of the divinity, it was their fundamental doctrine in ethics, that in human life one ultimate end ought for its own sake to be pursued; and that this end is, to live agreeably to nature, that is, to be conformed to the law of fate by which the world is governed, and to the reason of that divine and celestial fire which animates all things. Since man is himself a microcosm, composed, like the world, of matter and a rational principle, it becomes him to live as a part of the great
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great whole, and to accommodate all his desires and purposes to the general arrangement of nature.

To live according to nature, as the Stoics teach, is virtue; and virtue is itself happiness; for the supreme good is, to live according to a just conception of the nature of things, shewing that which is in itself eligible, and rejecting the contrary. Every man having within himself a capacity of discerning and following the law of nature, hath his happiness in his own power, and is a divinity to himself. Horace seems to have adopted this notion, Ep. i. 18.


"For life and wealth to Jove I'll pray;
Thrice Jove can give or take away;
But for a firm and equal mind,
This blessing in myself I'll find." Francis.

Wifdom, say the Stoics, consists in distinguishing good from evil. Good is that which produces happiness, according to the nature of a rational being. As the order of the world consists in the unchangeable conformity to the law of fate, so the happiness of man is motion, that course of life which flows in an uninterrupted current, according to the law of nature. Since those things only are truly good which are becoming and virtuous, and virtue, which is feated in the mind, is alone sufficient for happiness, external things contribute nothing towards happiness, and therefore are not in themselves good. The wise man will only value riches, honour, beauty, and other external enjoyments, as means and instruments of virtue; for, in every condition, he is happy in the possession of a mind accommodated to nature. Pain, which does not belong to the mind, is no evil. The wise man will be happy in the midst of torture. All external things are indifferent, since they cannot affect the happiness of man: nevertheless, some of these are conducive, others disadvantageable, to the life which is according to nature, and as such are proper objects of preference or rejection, ἐξουσίαν ἀποτελομικεῖ. Every virtue being a conformity to nature, and every vice a deviation from it, all virtues and vices are equal. One act of beneficence, or justice, is not more truly so than another; one fraud is not more a fraud than another; therefore there is no other difference in the essential nature of moral actions, than that some are vicious, and others virtuous.

The Stoics advanced many extravagant assertions concerning their wife man. For example, that he feels neither pain nor pleasure; that he exercises no pity; that he is free from faults; that he is divine; that he can neither deceive nor be deceived; that he does all things well; that he alone is great, noble, ingenious; that he is the only friend; that he alone is free; that he is a prophet, a prince, and a king; and the like. These paradoxical vauntings are humorously ridiculed by Horace, Ser. i. 1. 530:

The Stoics, however, did not suppose that their wife man actually existed; but they formed in their imagination an image of perfection, towards which every man should continually aspire.

The first object of pursuit, according to the Stoics, is not pleasure, but conformity to nature; and every one who has a just discernment of what is good, will be principally solicitous, in all his actions and pursuits, to conform to nature. This, they teach, is the origin of moral obligation. Violent emotions and passions, arising from false conceptions of good, are contrary to right reason and nature; and these it is the office of reason to prevent or remedy. Of virtues, some are contemplative, others practical; some primary, others subordinate. The contemplative scientific virtues are those which consist in just conceptions and principles: the practical, those which concern the conduct of life. The primary virtues are, prudence, temperament, fortitude, and justice. Prudence respects the choice and pursuit of goods; temperance, the government of the appetites; fortitude, the endurance of that which is commonly esteemed evil; and justice, the offices of social life.

Duties were distributed by the Stoics into three classes, as they respect God, ourselves, and our neighbour. The duties of religion are, to think justly concerning God, and to worship him piously. He thinks justly concerning God, who believes him to be the supreme director of human affairs, and the author of all that is good and fitting in human life. He worships God piously, who reveres him above all beings; who perceives and acknowledges him in all events; who is in every thing resigned and obedient to his will; who patiently receives whatever befalls him, from a persuasion, that whatever God appoints must be right; and in fine, who cheerfully follows wherever divine Providence leads him, even though it be to suffering and death.

The sum of a man's duty with respect to himself is, to fuzz his passions of joy and sorrow, hope and fear, and even pity. He who, in this respect, perfectly masters himself, is a wise man; and in proportion as we approach towards a state of apathy, we advance towards perfection.

The duty we owe towards others, is to love all men, even our enemies. A good man will love his neighbour from his heart, will refrain from injuring, and take pleasure in protecting and serving him. He will not think himself born for himself alone, but for the common good of mankind, and will shew himself kind to all, according to his ability. He will think himself sufficient; he has no care of well doing, and will never cease to do good, although he has no witness of his good deeds, nor is ever likely to receive any applause or recompence for his beneficence. The wise man never remits the punishment due to a criminal through pity, which is a weakness not to be indulged; nevertheless, in cases where reason suggests a sufficient ground for clemency, he will not treat a delinquent with rigour. He will relieve the sick, assist the shipwrecked, afford protection to the exile, or supply the hungry with food, but he will not contend for wealth with an undisturbed mind, and cherish all frymoral and impracticable. The piety which it teaches, is nothing more than a quiet submission to irresistible fate. The self-command which it enjoins, annihilates the best affections of the human heart. The indulgence which it grants to suicide is inconsistent, not only with the genuine principles of piety, but even with that constancy which was the height of Stoiic perfection. And even its moral doctrine of benevolence is tinctured with the fanciful principle, which lay at the foundation of the whole Stoiic system, that every being is a portion of one great whole, from which it would be unnatural and impious to attempt a separation.

We must then conclude, that the ethics of Zeno and his followers,
followers, however splendid, and in many particulars well-founded, devoted, as a system, from the true principles of nature, and had a tendency to produce artificial characters, and to encourage moral affectation and hypocrisy.

Zeno, the founder of the Stoical system, had many disciples and successors; such were Peripæus, Aristo the Chian, Herillus, and Sphærus. His immediate successor in his school was Cleanthes. (See his article.) After Zeno, no philosopher more truly exhibited the character, or more illustriously displayed the doctrine, of the Stoics, than Chrysippus. (See Chrysippus.) The immediate successor of Chrysippus in the Stoic school was Zeno of Tarsus, or, as some say, of Sidon. The chair was next assumed by Diogenes of Seleucia, called also the Babylonian. (See his article.) His disciple and successor was Antipater of Tarsus. The last of that series of Stoics which belongs to the history of the Greek philosophy was Poliddonius. See Polidionius.

The Stoic school was patronized by many eminent men in the Roman republic; but the man who claims more special notice, as a Stoic in character as well as principle, was the younger Cato. See his article.

The Stoic philosophy, which under the republic found many patrons, particularly among the professors of the law, continued to flourish under the emperors till after the reigns of the Antonines. Its ethical doctrine became the permanent basis of the Roman jurisprudence; and the high tone of wisdom and virtue which it assumed, induced many persons of great distinction and eminent merit to declare themselves of the Stoic sect, or at least to prefer its moral system to that of any other school. The prevalence of Christianity contributed also, in no small degree, to the success of Stoicism. Befides, the Stoic sect acquired great credit and authority from the illustrious examples of many persons of both sexes, who, in those times of civil opposition, bravely encountered death in the cause of liberty and virtue.

Among the heroes of this age, Tacitus mentions the two Arrias, the wives of Cæcina Petus and Thraeas, and Pætis the wife of Helvidius. For these and other causes, the Stoic sect, in the time of Juvenal, prevailed almost throughout the Roman empire. (Sat. xv. v. 103.) Under Antoninus Pius, schools of Stoicism were supported at the public expense in Athens, Alexandria, and probably too at Rome; for Antoninus, after he came to the purple, visited the house of Apollonius the Stoic to study philosophy. At Tarsus in Cilicia there was also a Stoic school, which produced several celebrated philosophers. The Stoic philosophy, however, struggled with powerful opposition from several quarters; and from the period when the meteley Eclectic system was established, Stoicism began to decline; and in the age of Augustus it no longer subsisted as a distinct sect. It was only during the short space of 200 years, that the Roman school of Zeno was adorned with illustrious names which claim a place in the history of philosophy. The first Stoic who merits attention in this period is Athenodorus, of Tarsus in Cilicia (see Athenodorus); Annæus Cornutus, an African, who lived at Rome in the beginning of the reign of Nero, and excelled in criticism and poetry, though philosophy was the principal object of his study (see Cornutus); Caius Mæonianus Bus, who was banished by Nero to Gyarra, but afterwards recalled by Vespasian (see Mæonius); Cheremon, an Egyptian; Lucius Annæus Seneca (see his article); Dio, of Prusa in Bithynia, called for his eloquence Chrysophom; Euphrates of Alexandria; Epictetus (see his article); Sextus, of Cheronea in Boeotia; and, last of all those whom we shall mention, the great and good emperor, Marcus Aurelius Antoninus. (See his article.) From the time of the Antonines to that of Alexander Severus, there were public schools of the Stoics in Athens and Alexandria; but their doctrine was corrupted by the prevalence of the Eclectic philosophy. In the sixteenth century some attempts were made for reviving the Stoic philosophy by Lipsius, (see his biographical article,) Galper Scipionius, Daniel Heinlius, and Thomas Gataker. See Brucker’s Hist. of Philosophy in Einfeld, vols. i. and ii.

STOICA, in Geography, a town of Hungary; 10 miles N.W. of Calchau.

STOKAIM, a town of Prussia, in Natangen; 30 miles S.S.E. of Konigberg.

STOKE, a township of Lower Canada, on the St. Francis river, N. of Alcots.

Stoke’s Bay, a bay on the S. coast of Hampshire, between Portsmouth harbour and Southampton river, S. of Gosport.

STOKE-COURCY, a parish of large extent in the north-west corner of the hundred of Cannington, and county of Somerset, England. One extremity of this parish is a long, narrow peninsula, called Start Point; which stretches nearly four miles into the sea, and terminates at the western edge of Bridgewater bay. The river Parret empties itself into the sea at this point. The town of Stoke-Courcy consists chiefly of one long street, and is situated at the southern extremity of the parish: it is studded in ancient records, the borough and honour of Stoke-Courcy, and the above-mentioned street still retains the former of these appellatives; though we do not find that it sent members to parliament more than once in the time of Edward III. It was formerly privileged with a market; this, however, has been long since discontinued; but here are yet held two annual fairs. Near the old croses, in High-street, are two fine springs, inclosed within cisterns, which, after supplying the inhabitants with water, unite with the brook that runs near the town, and fall into the sea at Stoford. The church of Stoke-Courcy, built at several periods, is a large building, with a tower in the centre, supported by four large arches. The eastern end of this edifice is of great antiquity, and was the priory church belonging to the priory of Benedictine monks, which was formerly founded near this place. The arches which separate the body of the church from the north and south aisles are semicircular, and sprang from very rich capitals. The name of Stoke-Courcy is Saxen, the former word signifying a village, and the latter the name of its original proprietor; whose ruined mansion lies a short distance to the south of the town. This parish, inclusive of Fairfield, contained, in 1811, 1208 inhabitants, and 228 houses. — History of Somersetshire, by the Rev. John Collinson, 4to. 1791, vol. i.

STOKEN, a town of Switzerland, in the canton of Zurich; 16 miles N. of Zurich.

STOKERAU. See Stockerau.

STOKES, a county of North Carolina, in Salisbury, divided, bounded E. by Rockingham and W. by Surry, containing 11,645 inhabitants, of whom 1746 are slaves. The capital is Germantown.

STOKES, a town of North Carolina, near the Yadkin; 20 miles N.N.W. of Salisbury.

STOKESIA, in Botany, was so named by L’Heritiers, in honour of Jonathan Stokes, M.D., well known as the coadjutor of Dr. Withering, in his Botanical Arrangement of British Plants; and particularly distinguished for his critical acuteness, displayed in his references to figures throughout that work. Dr. Stokes has recently published an elaborate Materia Medica, in four octavo volumes, disposed

Gen. Ch. Common Calyx ovate, somewhat imbricated, with leafy scales. Cor. compound, radiated; florets tubular, all perfect; those of the disk numerous, regular, in five equal segments; those of the radius larger, funnel-shaped, with a dilated, five-cleft, unequal limb. Stam. Filaments five, capillary; anthers united into a cylindrical tube. Fil. Germin angular; style thread-shaped, the length of the stamens; stigmas two, divided. Pet. none, except the permanent calyx. Seed to each floret, solitary, oblong; those of the disk with four angles; those of the radius with three. Down of four erect bristles in the seeds of the disk, of three only in those of the radius. Results. naked.

Eff. Ch. Receptacle naked. Seed-down of three or four bristles. Calyx leafy, somewhat imbricated. Florets of the circumference funnel-shaped, irregular. 1. S. cyanus. Blue Stokaria. Iwldl. n. i. Ait. n. i. (Carbohydrates. — Hill. Hort. Kew. 37, n. 5.) — Native in South and Central Europe. Cultivated at Kew from about the year 1766, when Mr. Gordon is said to have introduced this elegant plant. It is perennial, flowering in August, requiring shelter in winter. The stem is erect, simple, leafy, about two feet high. Lower leaves lanceolate, clasping the stem, toothed at the base; upper sessile, heart-shaped, serrated; all smooth, bright-green. Flowers large and very handsome, of a fine blue. It is by mistake that Hill and L. Heritier are cited as having given figures of this plant.

STOKESLEY, in Geography, a town in the west division of the liberty of Langbrough, and North Riding of Yorkshire, at the distance of 342½ miles north-west from London, and 43½ from York. In 1811 it contained 388 houses, and 1435 inhabitants. The lordship of Stokesley, at an early period, was granted to the family of Balbil, and was possessed by Gay de Balbil, who came into England with king William I. The manor, after descending through the family of Forster, has since been sold to the Rev. Mr. Hillyard, the present proprietor. The town is situated on the north side of a large branch of the rivers Swainby and Brimley, chiefly by one broad street. The buildings are principally modern, with the exception of the stables and the toll-booth, which have an appearance of antiquity. Though no evidence of the original foundation of St. Peter's church in this town can now be produced, yet a church is mentioned in the Domesday survey. About 1363, a chantry was founded at the Virgin's altar, within this building, by William de Stokesley, for the repose of the souls of John de Middleton and his wife. There is a church at the eastern extremity of the town, of modern erection, but the ancient town is yet remaining. The rectory-house was rebuilt in the year 1592, and is an agreeable residence, greatly improved by the present incumbent, the dean of York. Adjoining to the church-yard, on the north, stands the manor-house, a square stone edifice, with gardens, and a rising shrubbery in front. This town is endowed with two fairs, and a weekly market, held on Saturday. The petty fellows for the western division of Langbrough are held here. The parish of Stokesley is of considerable extent, and includes an area of about seven square miles. Within its limits are contained the townships of Stokesley-Bubby and Eastby, with the hamlet of Tameton, and a part of Newby. These were manorial residences held under feudal tenures; little remains of their ancient greatness are visible. Eastby Hall, formerly a seat of the lords Eures, now falling to decay, and an ancient chapel at the south end of the village, dedicated in 1540, are the only vestiges left. The environs of Stokesley are fertile, and the lands near the town chiefly laid into pasture. — Beauties of England and Wales, vol. xxvi. Yorkshire; by J. Bigland. History of Cleveland; by the Rev. John Graves, 410. 1808.

STOKEDORFF, a town of Austria; 4 miles N.E. of Sonneberg.

STOKOLETZ, a town of Croatia; 12 miles S.W. of Petrova.

STOLATZ, a town of European Turkey, in the province of Servia, on the Morava; 30 miles N.N.W. of Nisca.

STOLBERG, a town of Saxony, in the circle of Erzgebirge; 8 miles S.W. of Chemnitz. N. lat. 50° 46′. E. long. 12° 42′. — Alto, a town of Westphalia, capital of a county to which it gives name, and residence of the counts; 40 miles N. of Erfurt. N. lat. 51° 29′. E. long. 11° 5′. — Alto, a town of France, in the department of the Loire; 3 miles S.S.W. of Eichweiler. — Alto, a county situated in Thuringia; about 20 miles long and 15 broad. It affords good pasture and arable land, with some rich mines of copper and iron, some fine woods, and plenty of game; now annexed to the kingdom of Westphalia.

STOLBOVOI, a cape on the E. coast of Kamchatka; 40 miles E. of Kamchatskoii. N. lat. 56° 25′. E. long. 161° 44′.

STOLCKERN, a town of Austria; 3 miles S.W. of Eggenburg.

STOLE, STOLA, from coen, signifying a long robe, or tippet, a sarcodotic ornament, worn by the Romish patriarchs over their furpile, as a mark of superiority in their respective churches. The robe is worn by other prelates over the alb, at celebrating of masses; in which case it goes across the flamusch; and by deacons over the left shoulder, scarfsive.

The robe is a broad swath, or strip of cloth or stuff, hanging from the neck to the feet, with three croffles upon it. The bishops anciently pretended, that the patriarch-riplets were never to appear before them but in their floses, in Flanders and Italy they always preach in floses. It is supposed to be a representation of the borders of the long robe worn by the Jewish high-priests.

The robe of the ancient Romans, &c. was very different from that now in use; the former was a kind of robe fitter for women than men, though it was held a robe of honour among all nations. Kings themselves sometimes used it, and sometimes bestowed it as a reward of virtue.

STOLE, Groom of the, the eldest lord of his majesty's bed-chamber, whose office and honour is to present and put on his majesty's first garment or shirt every morning; and to order the things in the chamber.

STOLE, Order of the, an order of knights instituted by the kings of Aragon; though, as to the particular author or time of the institution, we are in the dark. The first time we hear of it is under Alphonfus V. who mounted the throne in 1416. Juquinian takes it to have been instituted about the year 1332.

STOLE, Order of the Golden, a military order at Venice, thus called from a golden flose, which the knights wore over their left shoulder, reaching down to the knee, both before and behind, a palm and a half broad. None are raised to this order but the patricians, or noble Venetians. Juffinian observes, that the time of the institution of this order is unknown.
STOLHOVEN, in Geography, a town of Germany, in the duchy of Baden, not far from the Rhine; 16 miles N. N.E. of Strasbourg. N. lat. 48° 45', E. long. 8° 7'.

STOLLEN, a town of Prussia, in the province of Oberland; 3 miles E. of Liebhadt.

STOMERZ, a town of Austrian Poland, in Galicia; 28 miles E. of Lemberg.

STOLNOWICZ, a town of Russian Lithuania; 30 miles S. of Novogrodok.

STOLPE, a town of Prussia, in the province of Ermland; 4 miles N.E. of Allenstein. — Allo, a river which rises in Pomerania, and runs into the sea; 25 miles W. of Dantzig. — Allo, a town of Anterior Pomerania; 5 miles W. of Anolam. — Allo, a town of Farther Pomerania, on a river of the same name, which here begins to be navigable to the Baltic. It contains three churches, and a Lutheran convent for ladies. The trade is considerable; 80 miles N.E. of Stargard. N. lat. 54° 25'. E. long. 16° 43'. — Allo, a river of Farther Pomerania, which runs into the Baltic at Stolpmunde. — Allo, a lake of Brandenburg, in the Mark of Pregnitz; 2 miles E. of Kyritz. — Allo, a town of Brandenburg, in the Ucker Mark; 6 miles S.E. of New Angermünde. N. lat. 52° 58'. E. long. 14° 14'.

STOLPMUNDE, a town of Farther Pomerania, situated on the coasts of the Baltic, at the mouth of the river Stolpe. 10 miles N. of Stolpe. N. lat. 54° 32'. E. long. 16° 33'.

STOLPEN, a town of Saxony, in the margravate of Meissen, with a citadel. In 1632, this town was burned by the Croats; and in 1765, the fortifications of the citadel were destroyed by the Prussians; 33 miles W.N.W. of Zittau. N. lat. 53° 41'. E. long. 14° 5'.

STOLTENBERG, a town of Pomerania; 10 miles S.S.W. of Corin.

STOLTZENBURG, a town of Transylvania; 6 miles N. of Hermensdlaft.

STOMACHACE, in Medicine, from φτόμαι, the mouth, and καύσις, emer, an erosion of, and spontaneous hemorrhage from, the gums and internal surface of the cheeks, together with an unusual factor of the mouth, is, in fact, a symptom of scurvy, or purpura, affecting that part. The term is sometimes used as an appellation of scurvy. See SCURVY and ΗΜΟΡΡΗΓΙΑ.

STOMACH, in Anatomy and Physiology. (Funiculus. Stomachus,) the large membranous bag, constituting the amplest portion of the alimentary tube; intervening between, and communicating with, the oesophagus and duodenum; receiving from the former the food which has undergone mastication, digesting it, or converting it into an uniform pulp, and transmitting it into the latter; situated in the upper part of the abdomen. It may be regarded as the commencement of the digestive apparatus; for in it the food undergoes the first change of properties in that series of changes, which ends in its assimilation to our organs: the oesophagus, which precedes it, serves merely to convey the aliment from the mouth; and the act of mastication is a simply mechanical process, auxiliary, but not essential, to digestion.

The stomach is a conical bag, being large at one end, and gradually decreasing to the other; hence the terms, great or left, and small or right extremities (extremitas oesophagi, superior, major; cardia; and extremitas pylorica, inferior, minor; pylorus.) It has two openings: a circular one with smooth sides, and no thickened or elevated ring, which is the termination of the oesophagus, and called the superior, cardiac, or oesophageal orifice; a smaller, also circular, surrounded by a thick prominent ring, called the inferior or pyloric orifice, through which the digested aliment is transmitted into the small intestine. Any perpendicular section of the stomach is circular: the largest circle is opposite to the termination of the oesophagus; from that point the diameter gradually diminishes to the pylorus, where the stomach is not larger than the duodenum. The stomach also diminishes from the oesophagus in the opposite direction, or towards the great end, and forms a small hemispherical blind bag (fundus, facies cæcum), passing about two or three inches to the left of the oesophageal orifice. The two apertures, therefore, are differently circumvallated in their relation to the two extremities: the pylorus is actually at the right extremity, while the cardiac opening is placed two or three inches to the right of the left extremity. The conical tube of the stomach is incurvated towards its small end; two-thirds of the bag, from the great end, are straight; but the remainder is bent upwards or backwards, so that the pylorus is turned towards the cardiac orifice: hence these two openings are near together on the upper or back aspect, very far apart on the front or lower. The concave line joining the former arch or curve of the stomach to the fundal or fundal curve; the convex line, by which they are united in the latter, the great arch or curvature of the stomach. The surfaces, included between these lines, are called the superior or anterior, the inferior or posterior. For the best view of the human stomach, see plate xi. fig. 1, in the Phil. Trans. 1807, in illustration of a paper by Sir Eeverard Home.

When the stomach is full, a vertical section of it, at any part, as we have already observed, is circular; when it is empty, its sides, formed of soft membranes, fall together. The organ, in the latter state, is quite flat. The size of the organ depends on the quantity of its contents, since its sides have the power of accommodating themselves to every variation of this kind. When perfectly empty, it is hardly larger than an intestine. It is difficult to determine its capacity. Soemmering says, that in an adult of middle stature it will hold, when moderately distended, from five to eleven pints of water. In various unnatural states, we find its capacity much augmented. Very frequently we find, after death, the great end more or less distended, and the small extremity empty and contracted; often too, there is a muscular confection about the middle, dividing it imperfectly into two compartments.

The stomach is situated in the epigastric region, and chiefly in the left portion of that region; its long axis being nearly transverse, or crossing the axis of the trunk at right angles. The great extremity is placed in the left hypochondrium, with the spleen attached to it behind by means of the omentum, and the diaphragm in contact with it towards the front. It stretches across the vertebral column, and ends, by its lesser extremity, in the left hypochondrium. The small lobe of the liver covers it above, being interposed between the stomach and diaphragm, so that these are in contact for a small space only at the left: the pancreas and colon are in contact with it below. The oesophagus lies on the middle of the spine: the small curvature includes, in its curve, the lobulus Spigelii and the aorta. The eniform cartilage does not answer to the middle of the stomach, but rather to its right portion: the pylorus corresponds nearly to the fundus of the gall-bladder, or to the notch between the two lobes of the liver. The openings of the stomach are placed farther back than the stomach itself; and this is particularly the case with the oesophageal: the latter is also higher in the body, by about two inches, than the pyloric. From the small arch, which is turned towards the spine, the
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Small omentum departs to the liver: the convexity of the great arch approaches to the front of the abdomen, and the great omentum descends from it in its whole length.

The stomach, therefore, occupies the space included between the false ribs, extending across the open interval between those of the right and left side: it does not usually descend lower than the margin of the chest, except when very full.

The relative position of the stomach is subject to change from many causes, particularly from its various conditions of fullness and emptiness. Its position in the dead subject may be called perpendicular; the bowels sink down, rather than rise, the support of the abdominal musculature is lost, and the parts naturally belonging to the epigastric region descend into the umbilical. The cæophagus descends into the stomach, and the pylorus ascends: the great arch is turned downwards, the small upwards: the upper surface is now anterior, and in contact with the front of the abdomen; the other surface is posterior; the position of the spleen, following that of the stomach, is also perpendicular, with the two extremities turned upwards and downwards. The relations of the organs are different in the living subject; the refraction of the intervals of the two arches is that the fundus of the stomach is higher; the posterior surface is at the same time rather turned upwards, and the posterior downwards; the great arch is forwards, the small backwards; and the cæophagus entering the organ, is rather inclined forwards. When the cavity is distended, all these circumstances are more strongly marked; the anterior surface is now turned completely upwards, the posterior downwards; the great arch stands forwards against the abdominal parieties, the inferior is turned directly backwards. When the stomach is in a free position, it is by the fovea gastrica that it is fastened to the wall of the body; and to this point the stomach is connected by the term cæophagus.

The cavity is not entirely occupied by the stomach, but is surrounded by a copious cellular tissue. In this situation, the stomach is not covered by serous membrane. For some distance from the curvature, on each side, the peritoneal coat can be easily separated from its connective tissue. When the stomach is distended, it rides in these situations above the peritoneal coat, and is then applied to its surface; while, in the empty state, they are in contact with each other.

The muscular covering is the thickest portion of the organ, enabling it to execute the motions which are necessary in the performance of its functions. It consists of a thin, nearly uniform layer of fibres, spread out into one continuous sheet like a membrane; and it will, of course, appear thicker or thinner, according as the stomach is contracted or expanded. Independently of this circumstance, it is found to be composed of two layers, which are then applied on its surface; while, in the empty state, they are in contact with each other.

The stomach is divided into two portions, the cardiac and pyleic. The cardiac portion is oblong, pale, not red, like those of the voluntary muscles. Two orders of fibres are easily distinguished, longitudinal and circular. The former are exterior, and much the fewest in number: they consist of the longitudinal fibres of the stomach, expanded in a radiated form in all directions from the end of that canal over the stomach. The most considerable of them run along the small arch as far as the pylorus, and may then be traced into the duodenum. Others go towards the great cæophagus, and are scattered over the two surfaces. These longitudinal fibres decussate the circular ones obliquely at different angles, and mix with them, ending amongst them. The circular fibres are much more numerous, and form a continuous covering over the whole stomach. They are rather thin at the great cæophagus, but they increase in thickness towards the opposite end. They form numerous rings parallel to each other, connected together, and extending from one extremity to the other. The individual fibres do not surround the stomach; but one ends, and another begins, and they partly turn aside to mix with other fasciculi. These circular fibres are continuous with the sheath of the cæophagus on one side, and with those of the duodenum on the other. At the pylorus they are collected into a thick ring, which forms the constriction of the canal at that part.

The mucous membrane, forming the internal surface, is the most important part of the stomach. It does not possess the fame power of accommodation to various capacities, as we find in the serous and muscular coats: hence, although it is smooth when the stomach is distended, it is collected all over the organ into numerous prominent folds, or rugae, when the cavity is contracted. The mucous coat is connected to the muscular by a very copious and loose cellular tissue, so that it can easily accommodate itself to the contractions...
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tractions of the latter. These rugae, which we see even in a half-filled stomach, consist merely of the mucous membrane; the feros and muscular have nothing to do with them. When the cavity is very empty, the rugae lie so close that they touch each other laterally: if the coats of such a stomach are diffused in any way, all these prominences disappear. The principal fibres of the stomach being circular, and their contraction consequentely taking place in the transverse direction, the folds produced by them are longitudinal, or follow the long axis of the stomach; these, which are the principal, are joined by smaller lateral folds. The cellular substance on the external surface of this membrane is the nervous coat of Haller, and other anatomists. It is soft, copious, whitish in its colour, and raised by inflation into the appearance of a downy or cotony texture. The blood-veals of the organ ramify in this, before they enter the mucous surface.

Besides the great folds of the mucous membrane, we observe several less considerable ones, composing a net-work with larger or smaller intervals: these are all defined by extension. The mucous membrane then appears as a smooth surface, but soft and rather pulpy; it is the kind of surface called villous, which is the usual name given to the membrane, although it does not possess the fine pointed processes which constitute the villi of the small intestines. The mucous membrane, in its most recent state, has a tint formed by the mixture of a very light red and a straw colour. Its true character is not easily seen, as the surface is generally covered by a closely adhering tenacious mucous layer. Soon after death, the translucence of the blood through the blood-veals gives a different colour to the mucous membrane. Often, even in the healthiest subjects, there is considerable vascularity observable in the mucous surface of the stomach; and more particularly when death has been accompanied by circumstances, which might impede the return of the venous blood. This appearance (which does not indicate any disease of the organ) has often been deemed the refut of inflammation. (See a paper by Dr. Yelloly, in the fourth volume of the Medical-Chirurgical Transactions.) The capillary system exists in great abundance in the mucous membrane of the stomach; so that it becomes of a uniform red, when the blood-veals are injected with fixe and vermilion.

It has been questioned, whether the fluids secreted from this surface are exhaled from its capillaries immediately, or are secreted in a distinct apparatus of mucous glands. The latter are not easily seen, but they have been described by several anatomists. After defecating them in various animals, Haller says, "they are not equally evident in man: I have generally been able to observe pores, which are visible all over the surface, and more numerous about the pylorus; from these, mucous fluid can be expressed. Others describe excretory ducts, and orifices, and fluids expressed from them. Occasionaly, there is a film of the glands themselves, of the nature of crypts, simple, round, membranous, hollow, situated in the cellular membrane under the mucous coat, and perforating the latter by their short ducts." (Elem. Physiol. tom. vi. p. 139.) Sommerring speaks of the orifices of mucous glands as being visible about the pylorus, but not always very conspicuous. (De Corp. Hum. Fabric. tom. vi. p. 225.) Lastly, they are delineated in considerable number, along the small curvature of the stomach, in the figure already referred to, published by Sir E. Home.

The mucous membrane of the stomach is continuous with that of the oesophagus on one side, and with that of the duodenum on the other; but differs clearly in its structure from both. The lining of the oesophagus has nothing villous in its structure, which is compact, smooth, and remarkably white: it is produced into the oesophageal orifice of the stomach, round which it terminates in a feathery border. See Sir E. Home's plate.

The communication between the stomach and duodenum is formed by the pylorus (janitor, siphincter), a contracted orifice surrounded by a thick ring. The serous membrane and the mucous are the same in the pylorus as elsewhere; the ring is formed by a thick set of circular muscular fibres. Someerring speaks of the pyloric ring being composed "e peculiaris glandulofo pene subfusitus?" but this does not accord with our own observation. The folds of the mucous membrane pass through the pylorus into the duodenum; consequently the orifice is plaited internally. If the stomach and duodenum be laid open after death, without disturbing the parts, the pyloric orifice will be found about equal in diameter to a goose-quill, and its circumference plaited. The finger can, however, be easily forced through it, enlarging the opening, stretching the mucous coat, and destroying the folds. It then appears a simple circular opening, with a thick prominent edge. If the small end of the stomach and the neighbouring portion of the duodenum be inflated, the pyloric constriction is very visible externally: if such a preparation be dried, it appears as if a firing had been tied round, and on cutting the parts open, a transverse production is seen, perforated in its middle by a circular aperture. Some unimportant varieties of figure have been observed in this opening: viz. it has been seen oval, or oblong, &c. instead of circular.

The office of the pylorus, as its name implies (from von, a gate, and wacht, a keeper), is to protect the entrance of the intestine, and prevent the passage of the alimentary matter, until it shall have sufficiently undergone the action of the stomach. Its muscular structure enables it to accomplish this effectually; for it can contract so as completely to shut the opening, in which state it is sometimes found after death; at the same time it has the power of relaxing, and thus allowing the alimentary pulp to pass. This contraction and relaxation are probably regulated by the existence of some relations between dilated and undilated substanres, and the peculiar sensibility of the organ; there is no mechanical explanation of the phenomenon, which is quite a vital process. The refutation of this muscular ring is different in the case of solids and fluids; it allows the latter to enter the intestinal canal easily, as we find from the rapidity with which they gain admission into the circulating system; and also from the short time after drinking, in which they flow out from the intestine, when an unnatural external opening from its canal gives us the opportunity of observation. Although the pylorus is commonly found after death of the dimensions already specified, we cannot doubt that it is much larger during the passage of the chyme; indeed we occasionally find solid substances of considerable dimensions passing this part. This is principally the case with pieces of coin, swallowed either by accident or design. Vaillant, a celebrated French medallist, swallowed twenty valuable gold medals, when purg'd by corfours; the processes of nature refined him the treasure in a short time; and he fold one of them, by anticipation, before it had made its appearance. A boy is mentioned by Hablot, in his "Question Chirurgicale sur la Bronchotomie," who swallowed several pills, which were recovered in the same way. Half-crowns, and we believe also crown-pieces of this country, have travelled safely through the alimentary canal.

The arteries of the stomach are numerous, and form of them large: they are all branches of the celiac, or its primary ramifications: viz. coronaria ventriculi, pylorica, gastrico-
Different chemical and vegetable substances produce specific effects on the stomach, which are not in proportion to any of their sensible qualities: various substances, insipid or nearly so, disturb it most vehemently, while others of powerful taste and acid nature, as the strongest condiments, which heat the whole frame, do not affect it. The diluted water of the laurocerasus, emetic tartar, and several others, are of the former kind, although they hardly excite pain in the conjunctiva of the eye. Cinnamon, pepper, and mustard, of which the slightest contact with the eye would produce excruciating agony, are not felt in the stomach.

Great variety is observed, in different animals, in the effects of various substances, both chemical and vegetable, on the stomach. Conium maculatum, hyoscymus, euphorbium, and hellebore roots, are poisons to man; while conium affords wholesome food to the cow and hare, hyoscymus to the pig, euphorbium to the goat, and hellebore to the quail. A quantity of opium or arsenic, that would destroy a man, may be taken with impunity by a dog, which, on the contrary, is much more affected than man by a given dose of jalap or nux vomica. Bitter almond, which we eat with impunity, are poisonous to dogs and various birds: the mountain parsley is fatal to parrots.

Like other parts, the stomach becomes accustomed to stimuli, and can bear larger and larger quantities of opium, of somnific and spirituous substances.

Although, in its natural state, the stomach possesses but slight animal sensibility, it exhibits the most acute feeling under disease. Cramp of the stomach, and inflammation of the organ, are as painful as any affections of any parts of the body.

The most important circumstance in the physiology of the stomach, is the secretion performed by its mucous membrane. The nature of this, and the changes it produces in the food, are considered in the article Digestion.

It is an interesting subject of inquiry, how far the secretions of the stomach, and consequently the processes of digestion, are influenced by the brain, which is the immediate source of its nerves. It is not easy to determine the point, because the eighth pair supplies the lungs as well as the stomach; consequently the division of these nerves produces effects on the process of respiration, which are soon fatal. On the other hand, if they are divided on the oesophagus in the abdomen, the injury is too great for the animal to survive in such a way as to enable us to judge of its digestive powers. The experiments hitherto made tend to show, that the brain influences the stomach through the eighth pair. Le Gallois divided one nerve in a Guinea pig of eighteen months; the animal breathed tolerably well, and continued to eat; but the belly increased proportionally in size. It died four days and five hours after the operation; the stomach occupied nearly the whole abdomen, diffused with food very little altered from the state in which it had been swallowed. Experiences sur le Prinçipe de la Vie, p. 214.

Mr. Brodie found, that the mucous and watery secretions, which diffuse the stomach and intestines in animals poisoned by arsenic, do not too rapidly take place, if the nerves of the eighth pair be previously tied, either in the neck, or in the cardia. Phil. Trans. 1814, p. 102.

It is well known that emetic tartar, injected into the veins, produces vomiting in a certain way, when introduced into the stomach: it has the same operation when brought in contact with any mucous or fereous surface, or with a wound. Mr. Magendie found that twelve or eighteen grains injected into a vein will kill a dog in half an hour. But if the

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nerves of the eighth pair be immediately divided, death does not take place till three or four hours after the injection. This physiologist selected three animals of the same age and weight, and injected into the veins of each twelve grains of emetic tartar. He divided one nerve in one dog; both trunks in another; and neither in the third. The latter died first; then the first; and the animal in whom both nerves were divided, lived the longest. De l'Influence de l'Emétique sur l'Homme et les Animaux, 2vo. Paris, 1814.

The muscular fibres of the stomach contract its cavity, and thus propel its contents, when they have been sufficiently acted on by the gastric fluid. Being longitudinal and circular, they can diminish the tube both in its length and breadth. The fibres contract and relax in peristaltic situations successively, and thus produce an appearance similar to that of the contractions and relaxations of the intestines: this is called the peristaltic motion of the stomach. These motions are not only visible when the organ is irritated in a living animal, but they may be seen on opening the abdomen of the recently slaughtered. The power of contraction continues for some time after apparent death, on the application of stimulants; and it may even be excited in a portion of the stomach cut out from the rest.

This contraction is completely foreign to the will: it takes place without our consciousness; and seems to result from the presence of the digested aliment. If diseased of the pylorus, or any other cause, prevent the passage of the food into the intestines, its presence irritates the stomach, and provokes its rejection by vomiting.

While the stomach is empty, it remains at rest; when the gastric secretions have acted on the food, we have already said that the muscular contraction of the organ expels the chyme through the pylorus. What is the state of the stomach, in respect to its muscular part, while digestion is going on? Is the stomach at rest, or does it present peristaltic motions by which its contents are agitated, exposed successively to the mucous surface, and more intimately mixed with the gastric secretions? Physiologists in general seem to admit the latter opinion, but we believe without any very direct proofs; which, indeed, it is not easy to obtain, as the division of the abdominal muscles, and the exposure of the stomach, cause an universal disturbance, instead of unveiling to us the natural state and actions of the animal organs. "It must be allowed," says Haller, "that for some time the action of the stomach does not direct the food to any certain point, but that the contents are driven to and fro by a peristaltic and antiperistaltic motion, which latter has been by some writers improperly disfigured. So long as both its orifices are shut, either the stomach must rest, or the food must be driven backwards and forwards. This agitation lasts while the oesophagus is closed, and the pylorus remains contracted; it ceases, when either the former or the latter gives way to the food." Elem. Physiol. lib. xix. sect. 4. § 10.

The stomach may contract in such a manner as to give its contents a direction contrary to their natural passage downwards: this is called the antiperistaltic motion. In this way air is expelled from the stomach in eructation, and an acrid liquor rises into the throat after feeding on indigestible matters, or in the affection of heartburn. In indigestion, the breath is often tainted in this way by stomachic impurities. Vomiting was considered also a result of this antiperistaltic contraction of the fibres of the stomach. Experiments on living animals, however, made this latter point doubtful. Bayle put his finger into the stomach of a dog, after giving him an emetic, and fearfully found the organ move; he observed further, that vomiting was stopped by opening the abdomen, and renewed when the wound was sewed up. chirac found that the stomach moved very feebly, if at all, under the action of an emetic; so that the violent symptoms of vomiting could not be explained from this cause. Other experimenters met with similar results, finding that the irritation of the stomach did not produce vomiting; that very little antiperistaltic motion of the stomach took place, or came on late in the process. Such was the result of Haller's investigations. The action of the respiratory powers was pointed out by Wepfer as the explanation of the phenomena of vomiting: he observed it in different animals, and has expressly referred to the diaphragm and abdominal muscles as the cause of this action, the stomach being nearly in the same position, and the same movements of other inquirers led them to the same result. "If," says Haller, "you observe a man who is sick, you will soon see that the stomach and respiratory muscles are both concerned. The original cause is in the stomach: the nausea, anxiety, feeling of depression approaching to fainting, and taking away all power of exertion, with pale face, small and weak pulse, have their seat in the stomach, and in the nerves affected by sympathy with the stomach. The organs of respiration come into action, and a violent effort or straining in the place, marked by short regular respiration; a deep inspiration, congestion of blood in the head, and pain, redness of the face, heat of the forehead, not unfrequently actual rupture of vesicles, and copious sweat as from the greatest exertion. The effects of vomiting are too violent to be attributed to the stomach: among them we may mention rupture of the oesophagus, protrusion of the stomach through the diaphragm into the chest." (Elem. Physiol. lib. xix. sect. 4. § 14.) To the same effect, Stoemming calls vomiting "motus ventriculi peristalticus inverius, cuius vi, adjuvante eam vehementissima diaphragmatis et musculorum oesophagi, quae contra eam operantur, atque os convulsivo impetu ejiciuntur." De Corp. Hum. Fab. t. vi. p. 169.

The examination of this subject has lately been refuted in France, and an interesting series of experiments, presented to the National Institute, has been published by their author, Mr. Magendie, in order to prove that the stomach is altogether inert in the act of vomiting. When one or two fingers were introduced through an opening in the abdominal parietes, it was found that the stomach did not act in vomiting; but that the diaphragm and abdominal muscles contributed to the act. At each retching, the action of the respiratory muscles could be felt, while the stomach was emptied without any diminution of volume, atmospheric air supplying the place of its rejected contents. When the incision was enlarged, so that the stomach could be brought out through it, vomiting was at an end. The retchings and efforts at vomiting could be renewed by placing the hands so as to compress the stomach. When brought out of the abdomen, and not compressed, it remained quiet, although emetic tartar was injected into the veins. The abdominal muscles being removed, vomiting was still produced by the action of the diaphragm compriing the stomach against the linea alba. If the phrenic nerves were divided so as to render the diaphragm motionless, vomiting could no longer be excited. Lastly, having tied the arteries of the stomach, Mr. Magendie removed it, substituting in its place a pig's bladder, containing a coloured fluid, which he connected to the oesophagus by means of a cannula, then leaved the abdomen, and injected emetic tartar into the veins. In a few minutes nausea was produced, and efforts at vomiting, and the animal actually vomited the contents of the bladder. On opening the abdomen again, it was found, that, on each effort
effort to vomit, air puffed into the bladder as if it had been the stomach itself. The author concludes from these facts, that emetic tartar injected into the veins does not act on the stomach, as is generally believed; but determines a convulsive action of the diaphragm and abdominal muscles. Mémoire sur le Vomissement, 8vo. 1813; or Journal de Corvisart, tom. xxviii. p. 192.

Another inquirer has taken up the same investigation, and has arrived, by experimental inquiry, at conclusions directly contrary to the preceding. After opening the abdomen, and removing the abdominal muscles, he transected a portion of intestine, and thus produced vomiting. When he had divided the phrenic nerves, and constricted the intestine through a small opening in the abdominal parietes, vomiting still took place. It even took place whenever any thing was introduced into the stomach, after cutting the phrenic nerves, dividing the abdominal muscles, and taking away a portion of the diaphragm, as far as the tendinous centre; the intestine was transected, as in the preceding experiments. He produced vomiting by injecting tartar emetic into the veins, after the abdominal muscles and diaphragm had been removed; so that the effect could not arise from any action of the emetic on those muscles, as is asserted by Magendie. These and other experiments in the same essay restore the stomach to the full enjoyment of its former rights, from which it seemed on the eve of being degraded, and go to prove, that the diaphragm and abdominal muscles are not the seat of vomiting. Mem. sur le Vomissement, par M. Maingault. 8vo. 1813; or in Corvisart's Journal, tom. xxviii. p. 193.

As the two experimentalists, whose researches we have just detailed, do directly contradict each other, we suppose that the point cannot be settled without a fresh slaughter of dogs, and a renewal of these truly barbarous and disgusting experiments. Our own opinion inclines to the side of Mr. Magendie, from observing the phenomena of vomiting both in ourselves and others; and the muscular power of the stomach, apparently calculated for the mere purpose of expelling the food through the pylorus, seems to us quite inadequate to account for the vehement and forcible rejection of the stomachic contents in vomiting. Yet we cannot but entertain doubts about the (at first sight certainly) paradoxical statement, of vomiting being excited when the stomach had been removed.

The causes that excite vomiting are numerous and various: Overloading the organ, and particularly with unusual mixtures of food and drink; the introduction of various animal, vegetable, or mineral substances called emetics; warm water, or atmospheric air; the injection of emetics into the veins, or the application of them, at least of arsenic, to a wounded surface; the dragging of the omentum in a hernia, the irritation of a broken rib pressing on it, obstruction in the course of the alimentary canal, &c. inflammation of the stomach, or disease of the pylorus: injuries of the head; calculus passing the ureters; pregnancy; particular motions of the body, as swinging, riding backwards in a carriage, turning round; to this head we may also refer sea-sickness; certain impressions on the organs of sense, as touching or seeing a disgusting object, disagreeable smells or tastes, tickling the fauces, &c. &c.

The causes of vomiting now enumerated are so different from each other, that we cannot expect to find out any circumstance in which they will all agree. Their only common character is the circumstance of their action on this viscus: they irritate it, and vomiting seems to be the common result of such irritation. Is the vomiting produced by an impression terminating in the stomach itself; or does it take place through the medium of the nerves? There are not, we believe, sufficient facts to determine this point.

As the digested aliment supplies the blood, which affords to all parts of the frame the materials of nutrition, growth and action, the right performance of digestion is a matter of the highest importance to the whole body: hence all parts sympathize with the stomach, which, in its turn, is affected by the various states of all other organs. When it is healthy and vigorous, we have a general feeling of strength and capacity for exertion. On the contrary, every faculty of body and mind seems to languish, when the stomach fails, as in dysepsia and nausea. Acute diseases of this vital organ testify its importance by the alarming sympathetic disturbance of the whole economy. A violent blow on it is sometimes immediately fatal. As digestion is ill or well performed, we are more or less sensitive to external heat and cold, to the qualities of food and drink; the fenes are more or less acute, and the passions of the mind affect us more or less easily. The fame morbid causes produce different effects according to the condition of the digestive function: when it is unhealthily executed, wounds, even in the most distant parts of the body, are much more dangerous; and their state will be immediately changed, as soon as healthy digestion returns. The existence of impurities in the stomach, as indicated by a foul tongue, tainted breath, flatulence, &c., during any great purgations, is not frequently attended with delirium and convulsions. In a word, there is hardly a disease, which is not either produced or aggravated by disorder of the stomach, indigestion as it is called.

The fact is so obvious, even to common observation, that the general debilitation and oppression of the frame from a loaded stomach have been described by poets.

At simul aphis
Muscuaria eliza, simul conchilia turdis;
Dulcia de f ilem vertent, stomachoque tumultum
Lenta feret pitiuta. Vide, ut palidus omnis
Cena defurtat dubia? Quin corpus onulitum
Hefternis vitis, animam quoque praevrat una,
Atque a fugit humo divine particulam aure.

No part is more quickly or remarkably influenced than the stomach, in all important general affections of the frame; and the state of this organ affords an important indication in the attack, progress, and decline of the disorder. Sickfulness is an early symptom in most fevers: the appetite is entirely destroyed; its return and increase are the surest criteria of abated disease and convalescence. Hardly can any part be disordered, as the eye, nose, &c., or any internal organ, or a joint, without sympathy of the stomach.

The sympathy between the head and the stomach is seen in the effects of various poisons, which, when introduced into the latter, quickly put an end to senation and voluntary motion (see Poison); in the phenomena of fick head-ache, as it is popularly and properly called (see cephalalgia); in the ataxismus, dilated pupils, itching of the nose, head-ache, paleness, delirium, and even convulsions produced by worms in the stomach; in the palsy and apoplexy produced by a full meal; in the squamae and even sickness caused by seeing or thinking of a disgusting object, &c. &c.

Numerous phenomena evince the influence of the stomach upon the heart: vis. the hurried circulation from eating or drinking strong or warm substances; the intermittent pulse, palpitation of the heart, &c. caused in some individuals by particular articles of food. We see the heart influencing the stomach, when sickfulness attends syncope. The coughing
arising from a loaded stomach, and even called the stomach cough, or from a wound of the stomach, and the effects of emetics in dittrefs of breathing, together with analogous occurrences, exemplify the mutual influence of the stomach and lungs. In hiccough, the diaphragm is influenced by the stomach, sicknees attends inflammation of the kidney, and the passage of calculi through the ureters. How powerfully the uterus acts on the stomach, is seen in the nausea, sicknees, heartburn, and depraved appetite attending pregnancy. The state of the skin in dyspepsia and other stomachic affections, and the numerous cutaneous diseaues, either caused or aggravated by disturbed digestion, clearly shew us the great mutual influence of these parts.

Respecting the circumstances which attend the introduction of poisons into the stomach, and the manner in which they prove fatal, we refer the reader to the article Poison.

STOMACH. Diseaues of the. The principal diseases to which the stomach is liable, are, inflammation; the various modifications of dyspepsia, or indigestion; and some chronic changes of its structure, which are not readily influenced by physical remedies. The two former classes of these maladies have been treated of at considerable length under their respective heads, to which we refer the reader. The acute inflammation of the stomach is described under its nosological term Gastritis: and the varieties of Indigestion are detailed under that head; and more particular explanations of certain modifications or symptoms of it, under the heads Cardialgia, Hematemesis, Gastrodynia, Nauka, Pyrosis, &c. It remains in this place only to notice those chronic diseases of structure in the stomach, which could not be included under these heads, and which are not capable of being much relieved by art. The nature of these is chiefly ascertained by an examination of the organ after death.

Both the apertures of the stomach are liable to be contracted, or to be the seat of friction, as it is technically called, under which condition suffering is produced. A friction of the cardiac, or upper aperture of the stomach, may be distinguished, according to Dr. Pemberton, from all other diseases of that organ, or of the neighbouring parts, by the production of pain on any attempt to swallow solid food. This pain has something peculiar in its nature, and is describ'd by the patient as very different from what is generally underfo'd by the word pain. It is a fort of tender, circumfered sensation about the pit of the stomach, striking through to the back, and producing a feeling of incipient suffocation. This continues till the food is rejected, which is done by an effort very unlike vomiting. It seems to approach nearer to that effort which occurs hiccough. After this rejection of the food, the patient obtains relief. In consequence of the inability to pass a sufficient quantity of nourishment through the contracted passage into the stomach, the body becomes very much emaciated, often to such a degree, that a tumour surrounding the cardiac may be discovered by a careful investigation in the region of the stomach.

A much common situation of friction is in the lower aperture of the stomach, leading into the intestines, which is called the pylorus: this, however, fortunately, is also a rare disease. Dr. Baillie mentions one case, which fell under his observation, in which the friction was so great as hardly to admit a common goose-quill to pass from the stomach into the duodenum, and it had prevented a number of plumstones from passing, which were therefore detained in the stomach: and he supposes that the passage may in some cases be entirely shut up. This friction occurring in the pylorus may be distinguished from friction of the cardiac, by the food readily passing into the stomach without exciting pain; and when it is thrown up it is by vomiting, and not by the peculiar effort before mentioned, when speaking of friction of the cardia. After the friction of the pylorus has continued some time, the body generally becomes much emaciated, as but little nourishment can pass into the intestines to be taken up by the labets, and the tumour, as in the former case, can then be discovered by examination of the abdomen. Pemberton: on Dif. of Abdom. Viucera, chap. vii.

Ulcers of the stomach occasionally occur, and have been described by Dr. Baillie as sometimes resembling common ulcers in any other part of the body, but frequently having a peculiar appearance. Many of them are scarcely surrounded by any inflammation, nor have they irregular eroded edges, such as ulcers have generally, nor are they attended with any particular diseased alteration in the structure of the stomach surrounding them. They appear very much as if, some little time before, a part had been cut out from the stomach with a knife, and the edges had healed, so as to present an uniform smooth boundary round the excavation which had been made. These ulcers sometimes destroy only a portion of the inner coat of the stomach at some one part; but occasionally they destroy a portion of all the coats, forming a hole in the stomach. It is probable that these ulcers of the stomach are often slow in their progress. They are attended with a slowly growing, uneasily feeling in the organ, and what is swallowed is often rejected by vomiting. This state of disorder often continues for a considerable length of time, and is little relieved by medicine, which may serve as some ground of distinction between this disease and a temporary deranged action of the stomach. Baillie's Morbid Anatomy, chap. vii.

Schirrus and cancer of the stomach are not uncommon affections at an advanced period of life. They appear to be more frequent in men than in women, which Dr. Baillie supposes may arise from the greater intemperance of the one sex than of the other. He admits, however, that these diseases are not entirely produced by intemperance, but only where intemperance concurs with a strong predisposition to them. It is surprizing to find the very extensive mischief which the structure of the stomach has in some instances undergone without the constitution being sensibly affected by it, provided the mischief is so situated as not to interrupt the passage of the food. Dr. Pemberton mentions that he has seen a large schirrus in the stomach, near the pylorus, with an open cancer in one part of it, which had made its way through the stomach, and then the left lobe of the liver; and an adhesion had taken place between the sides of the abdomen and the peritoneum: so that had not the patient been carried off by a disease in the aorta, it was probable that this adhesion would have made its way out through the intestines of the abdomen. Still, however, though this must have been a disease of very long standing, the body was but little emaciated, and the patient had never thrown any one symptom, by which such a disease of the stomach could possibly have been suspected. The writer of this article witnessed the existence of a solid, extensive, cancerous condition of the interior coat of the stomach, in which many large tubercles were found in a state of ulceration, in an elderly man, who, however, was not much emaciated, and who had never exhibited any more feverish symptoms, than those of slight indigestion, and, therefore, none that could lead to a suspicion of such an extensive and formidable disease. In general, however, when the schirrus has ulcerated, and formed what is called open cancer, there is a constant pain, though varying in degree, and which is increased by taking
taking any acid or acidulance into the stomach; whereas mild fluids, such as milk, gruel, &c. occasion little or no uneasiness. What is swallowed, in many cases, is often rejected by vomiting, and there is frequently thrown up also a dark-coloured fluid, which has sometimes been compared to coffee-ground. There is often an emaciation also of very fetid air. The patient commonly becomes emaciated, and the countenance falls; and the pulse is frequent, and hectic symptoms at length ensue.

The origin of the stomach, as ascertained by dissection, after death has terminated the course of the disease, is described by Dr. Baillie. "When the whole stomach, or a portion of it, is chichorous, it is much thicker than usual, as well as much harder. When the diseased part is cut into, the original structure of the stomach is frequently marked with sufficient distinctness, but very much altered from the natural appearance. The peritoneal covering of the stomach is many times thicker than it ought to be, and has almost a gritty hardness. The muscular part is also very much thickened, and is interlaced by many pretty strong muscle-tracts. The fleshy membrane is probably nothing else than the cellular membrane intervening between the falciculi of the muscular fibres, thickened from diseaze. The inner membrane is also extremely thick and hard, and not unfrequently somewhat tuberculated towards the cavity of the stomach. It very frequently happens that this thickened mals is ulcerated upon its surface, and then a stomach is said to be cancerous." Morbid Anatomy, loc. cit.

With respect to the treatment of these structural changes, little can be said; for, in truth, it must not be concealed, that secondary relief is all that can be expected under diseazes so deplorable. No physical means that we possess can change the morbid growth into healthy structure, or induce new actions. All that can be done, is to allay the pains of the patient, by administering gentle narcotics, such as eicantia and hyoscymus, and by employing a milk diet, or other soothing liquid and liquid food.

STOMACH of Birds. See Anatomy of Birds, and Digestion.

STOMACH of Fish. See Fish.

STOMACH of Flies. In examining with care the bodies of these little animals, one may perceive, that when the passage of the aliment is got beyond the lungs, and below the place where they form a port of diaphragm, the canal that served for this passage forms a large though short body, the diameter of which exceeds three or four times that of the canel itself. This body is composed of three chief lobes, and is unquestionably the stomach of the animal. The intestine goes out of it, very nearly from the same part where the other passage is admitted into it; the intestine then directs itself toward the anus, and afterward runs upward again toward the diaphragm, or bottom of the lungs; and thence, after many convolutions, many times running backward and forward, it terminates in the anus.

In caterpillars and butterflies, the canal from the mouth to the anus is only one straight intestine; but it is much otherwise in these creatures, the intestines, both in the fly, and in the worm from which it is produced, always making a number of contortions and convolutions.

STOMACH-Bugs. See EXUVIA Pntriculari.

STOMACH-Illy, in Rural Economy, a term sometimes applied to a disease in sheep that strikes them suddenly, which is probably of the braxy kind, and in which there is much pain and inflammation about the stomach. Infant bleeding is supposed to be the chief remedy. See Striking-Illy, or Blood.

STOMACHIC, Elixir stomachic, a medicine that strengthens the stomach, and promotes the office of digestion.

Of this kind are wormwood, rhubarb, mint, mastic, aloes, pepper, cinnamon, and aromatic bitters; good wine is also a stomachic.

STOMACHIC, in Anatomy, a name sometimes given to the arteries, nerves, &c. of the stomach.

STOMACHIC Coronary. See CORONARY.

STOMACHIC Elixir. See Elixir stomachic.

STOMACHIC Pills. See PILL.

STOMACHIC Water. See WATER.

STOMACHICA Ferris, the stomachic fever, a name given by Heister, and some others, to a species of fever, called by others a mesentric fever, and by our Sydenham nova fersis, in a peculiar treatise. See FEVER.

STOMATIA, in Natural History, the name of a genus of shell-fish, frequently confounded with the ear-shell.

The shell of the stomatia is formed of one piece, has no perforations in any part of its surface, and is of a depressed flat figure; and its mouth is the most patent of all the univalve shells, the limpet only excepted. It has a short spiral turn running into the mouth at the head.

There are several species of this genus.

STOMATICA, a term used by some for all medicines used in disorders of the mouth.

STOMBLE, in Agriculture, provincially a term which signifies to trample or pounce, as a wet foil by means of cattle flock, or in the time of ploughing, &c.

STOMOXYs, in Entymology, a genus of insects of the order Diptera: the generic character is: Sucker with a single-valved sheath, enclosing bristles in their proper sheaths; two feelers which are short and fetidaceous, with five articulations; the antennæ are fetidaceous. There are sixteen species, in two divisions.

Species.

A. Sheath convolute and geniculate at the Base, with two Bristles.

Morio. Black; fore-part of the thorax hairy, ferruginous; wings black, with white spots. This is found in Brazil. A specimen of it exists in the museum of Sir J. Banks. The head is ferruginous, with black proboscis, anten na, and femmata; abdomen black, with a blue gloss; the tips of the wings are whitish.

Grisca. The antennæ of this species are feathered; hairy, grey, with fetidaceous thigs. It is found in Germany. The proboscis is black, a little fetidaceous at the base; the head is white, with a fetidaceous line on the front; the wings are whitish; the legs black, with rufous thiggs.

Sibipita. Antennæ feathered; hairy, grey; sides of the abdomen pale diaphanous. It inhabits Germany. Orbits snowy; legs black, with pale thiggs.

* Calicitrans. Antennæ slightly feathered; grey, with black legs. This very much resembles the common fly, and is the insect which buzzes about the legs of cattle, making them continually flump with the feet; and which stings our legs in autumn.

Tessellata. Hairy, cinereous; abdomen grey, teffellate with brown. It inhabits Kiel, and is larger than the Sibirita; next to be described.

* Irritans. Cinereous, slightly hairy; abdomen spotted with black. This is found in many parts of Europe, as well as in our own country, and is extremely troublesome on the backs of cattle.

Muscaria. Antennæ slightly feathered; hairy, black; abdomen paler, with deep black bands. This is found in Denmark.
Danmark. The segments of the abdomen are black at the base; the wings are white.

Fugitiva. Cineous, with black 'thighs.' It is found in diverse parts of Europe, and harasses cattle, though it is of a diminutive size. The body is slightly hairy; the wings whitish.

Asiliformis. Antennae fuscaceae; the body is dusky; wings with black marginal spots. This is found in Italy. The sucker is short and yellow; the antennae are yellow, with a long fimbria hair; the legs are yellowish, hind-thighs black.

Stylata. Cineous; abdomen rufous, with a projecting style, black at the end; wings hyaline, with fine brown bands; every other one abbreviated. This inhabits Barbary.

Dorsalis. Black; abdomen fuscous on the back, with three pair of black dots. It inhabits France, and is small.

Longoce. Orbits white; thorax grey; abdomen grey-brown; legs ferruginous, black at the ends.

B. Sheads covering the Mouth, with free Bristles.

Rostrata. Thorax with obscure lines; proboscis, abdomen, and legs, asiform. It resembles the common fly, and is very troublesome to cattle.

Musciiformis. Thorax brown, with four whitish lines; abdomen black, with three pair of white lunules. This is also found in Germany. The proboscis is yellow, the tip emarginate and black.

Musciformis. Thorax brown, with four whitish lines; abdomen black, with three pair of white lunules. This is also found in Germany. The antennae are black, with a broad compressed ferruginous club; the mouth is hairy; the head is brown; the tail is blueish; legs yellow, spotted with black.

Stondle, in Rural Economy, the provincial name of a bearing tub, or any similar sort of vessel of the same kind.

Stone, Edmund, in Biography, a native of Scotland, the place and time of his birth being unknown, and an excellent mathematician. He was the son of the duke of Argyle's gardener, and probably born in the thire of Argyle, about the beginning of the laft or end of the preceding century. He was eight years old when he began to read, but afterwards he made very rapid progress by his own almoft unrivalled efforts. Before he attained the age of eighteen years, he had acquired a knowledge of the sciences in Latin, Greek, and Hebrew, and was proficient in the study of mathematics. He was of an acute and studious turn, and his mind was particularly directed to the improvement of his understanding. He was a diligent and indefatigable student, and his application to learning was unceasing.

The principal works of Stone were the following: "A New Mathematical Dictionary," first printed in 1726, 8vo; and "A Treatise on Fluxions," 1730, 8vo; the direct method being translated from the marquis de l'Hospital's "Analyse des Infiniments Petits," and the inverese method supplied by Stone himself; "The Elements of Euclid," 1732, 2 vols. 8vo., with an account of the life and writings of Euclid; besides some smaller works. Stone was a fellow of the Royal Society; and communicated to it an account of two species of lines of the third order, not mentioned by Sir I. Newton or Mr. Stirling, which was printed in the 41st volume of the Phil. Trans. Hutton's Math. Dict.

Stone, Henry, known by the name of Old Stone, to distinguish him from his younger brother John, was the son of N. Stone, a stationer. He is principally known as the copyist of many poetical works of Vertue, and they are exceedingly close in their resemblance to the originals. He passed several years in Holland, France, and Italy; but died in London in 1653.

Stone, in Geography, a market-town in the hundred of Pirehill, and county of Stafford, England, is 141 miles N.W. of London, 7 from the county town, and 34 from Birmingham. In the year 1811, this parish contained 463 houses, and 2314 inhabitants. At a remote time, Stone was distinguished by some monastic foundations. Wulfere, king of the Mercians, after lying at Grantham, was removed by the persuasion of his queen and St. Chad, to embrace the Christian faith, and founded a monastery, in 670, at this place, in expiation of his crimes. This became a college of regular canons of the order of St. Augustine. His queen, Ermesilda, next established a nunnery here; but both these houses were injured, and the inmates dispersed, by the Danes. After the Norman conquest, the college and nunnery were replenished with monks and nuns; at least it seems evident that Enfyan, a Norman, brought canons from Kenelworth, and made the establishment at Stone a more eminently collegiate house at Kenelworth, by the archbishop of Cant Pyne, about the year 1260, rendered the former independent of the latter. Several perfections of the Stafford family were interred in the church at this place, to whom some fine and curious tombs were reared; but these were removed, at the dissolution of the priory, to the church of the Augustines at Stafford-Green. A new church has been erected on the site of the old structure.

Stone consists mostly of one long street, in which is a newly formed market-place. In the town is a free-school, and an endowed grammar-school. There are a weekly market on Tuesday, and three annual fairs. By means of the Trent and Mersey canal, which comes to this place, there is regular and cheap communication with many of the great manufacturing and commercial towns of Lancashire, Staffordshire, Warwickshire, and more distant counties.

Near Stone, lord Archibald Hamilton, in the year 1773, built an elegant house, called Sandoon-Hall. This was formerly the property of the Erdfwick family, one of whom, Sampson Erdfwick, was authorized a topographical account of this county; and lies interred in the church of Sandon. Statues of himself and his two wives constitute parts of the monument, on which is a long and curious Latin inscription. He was born in this village in the middle of the sixteenth century, and died here April 1609. See Fuller's Worthies of England. Alco Chalmers's Biographical Dictionary.

In the vicinity of Stone was Afton-Hall, an ancient and magnificent mansion, surrounded by a moat, terraces, gardens, and a park. A large manufactory was erected in the gardens at this place by Sir James Simeon, who also rebuilt the house. The property now belongs to Edward Weld, Esq. of Lulworth castle, in Dorsetshire—Beauties of England.
STONE.

&c. vol. xiii. from Shaw's History, &c. of Staffordshire; and Penant's Journey from Chester to London, 8vo. 1811.

Stone, in Natural History and the Arts, is an inerated mass of earth. The solid parts of the globe are principally composed of stones, formed of the different earths more or less combined with each other, and in different states of induration. The physical and chemical properties of stones fall properly under the investigation of geology, yet the mineralogist, too, must study the order in which they are arranged over each other in the great sandy mists that compose rocks and strata, constitutes a part of the science denominated geology.

The ingenuity and industry of modern naturalists have led them to form a variety of systems in the arrangement of fossils in general, and of stones in particular; some of the principal of these may not be improper to enumerate. Some have founded the basis of their system on the figure, colour, structure, and other external and visible characters; calling in the aid of chemistry, so far at least as the mineral acids would affum it. Others, as the prospected chemists and metallurgists, have established their arrangement chiefly on chemical principles, as more immediately leading to the origin of fossil bodies in general. And, at present, mineralogists seem more intent on this view than ever, and probably the due consideration of the volcanic system will open new sources of information in this way.

With respect to the systematic arrangement of stones, Breconius, in 1730, distinguishes them into such as are permanent in the fire, such as the lapis calcarius, amiantus, albitubs, and fuscors; calcinable, such as the calcareous, flint, marmor, gyptum,spathum, flatacites, fissional, and specilais; and those that are vitrifiable in the fire, such as the arearia, arenarium, gemma, granatus, file, quartum, crytallus, and fluor. The other fossil bodies he ranges under the several classes of earths, salts, sulphurs, figured stones, petrifactions, calculi, semi-metals, and metals.

Wallenius, in 1747, divides stones into calcareous, as the calcareus, marmor, gyptum, and spatum; the vitrecis, as effliss, cos, files, petrufiles, quartzum, and crytallus; the argillaceus, as mica, amiantus, and albitubs; and sana, or rocky stones, as the amfite, mixtas, grites, and petrosa. The other bodies pertaining to the fossil kingdom, he classes under the general heads of earths, lean, fat, mineral, and arenaeous; minerals, sulphurs, semi-metals, metals, concrete subfiances, such as the pori, petrificationed, figured stones, and calculi.

Wolterdof, in 1748, divides stones into the vitrecis, as gemma, crytallus, quartzum, arenarium, cornes, koptum vitrecs, fens, and pumex; the argillaceus, as the amfites, albitubs, alcalium, and spatum crytallum, and the albitubs, as the calcareus, marmor, spatum alcalium, tophus, flatacites, and margodes. The other fossil subfiances he divides under the titles of earths, argillaceous and alkaline; salts, acid, alkaline, and mean; bitumen, fluid and solid; semi-metals, fluid and solid; metals, noble and ignoble; and petrifactions of fanguous animals, of insects, of tectaneous animals, of vegetables, and of marine bodies.

Carthusian, in 1755, distinguishes stones into the lamellos, as spatum, mica, and talcum; lamasommum, as amiantus, albitubs, and alcalium; fuscors, as files, quartzum, calcarus, guypus, fissional, and specilais; and cemented, as arenaeous and jalis. The other fossil bodies he classes under earths convertible and insoluble; salts, alkaline, acid, mean, and flypic; inflammables, both genuine and spurious; semi-metals, not malleable, sub-malleable, and fluid; metals, flexible, hard, and fixed; and heteromorphs, including the true and spurious petrifications, and the figured subfiances.

Jofi in 1757, distinguishes terraneous bodies into the noble, as the adamas, sapphire, smaragdus, amethystus, topazius, turcois, opalus, cryolitius, and hyacinthus; the semi-noble, as crystallus, cameo, chalcedonius, cryolithus, sardionus, malachites, and lazuli; opres ignobilis, as talcum, mica, molybdens, vitrum molochium, stelaiitis, cornes, jalis, and albitubs; calcareus, as marmor, gyptum, and spatum; and vitrecis, as cos, quartzum, files, chifus, serpentinus, tripomex, granites, fissional, argillae, margus, limus, and umbra. The other fossil bodies rank under the heads of metals, noble and ignoble; semi-metals, fluid, hard, and mineralized; salts, acid, alkaline, and mean; and petrifactioned animals, plants, obscurum, and figured, and crystall.

Cronstedt, in 1758, arranges fossils under the classes of earths, calcareous, silicious, granate, argillaceous, micaeous, fluent, albitubs, zeolitic, and magnetian; salts, acid and alkaline; philogonic bodies; and metals, perfect and semi-metals.

Vogel, in 1762, distinguishes stones into the argillaceous, calcareous, margeuseous, felentic, pyromacous, fchibous, folious, plumous, saline, metallic, fusile, petrae or rocky, and new; and the other fossils under the earths, argillaceous, calcareous, silicious, margeuseous, felentic, talcous, micaeous, inflammable, saline, metallic, and mould; petrifactions of animals, plants, lithophyous, lithomomous, and pori: salts, flupetic, fusile, such as are capable of being hardened, volatile, and alkaline; combustibles, as sulphureous, bituminous, fervum, and balans; and metals, perfect and semi-metals.

Next, in his " Lithogeognosia," distinguishes stones into calcareous, gypsumous, argillaceous, and aprous.

It has been doubted by some of the most respectable mineralogists, whether we ought to defend below what are called general distinctions in the fossil kingdom, because the subjects are infinitely various, and the gradation by which they run into each other is in general imperceptible in the various combined forms in which they are found in the earth. Nevertheless, some distinctions of this kind seem to be quite necessary in systems established principally on external characters.

Linnaeus and Wallerius have been among the first who attempted the arduous task of fixing the specific characters. For this purpose, Linnaeus has formed a set of terms that express all distinctions in the figures of fossil bodies, in their crust or outward appearance, their superficials, their corresponding particles or fibres, in their texture, whether plated, figial, &c. in their hardness, or in their colour, and in the alterations they undergo by solution, both by acids and by fire.

The chemical systematics and metallurgists, in their arrangements, usually begin with the earths, concerning them as the basis of stones: Linnaeus begins with the latter, professing to take a middle way between the mere metallurgists, and those who characterize from external appearance only.

He divides the whole regnum lapidum into three classes, under the names of petra, minera, and fossilia, each being subdivided into several orders, and comprehending in the whole fifty-four genera.

To the first class belong petra, or stones, which he defines to be fossil bodies, originating from a terrestrial principle by external pressure; these are simple, as in their composition they are destitute of saline, inflammable, and metallic principles; they are fixed, not as being entirely and intimately soluble in any menstruam; similar, as they confound of homogeneous component parts. Of these there are five orders; viz.,

1. The hemce, or flaty stones, which originate from vegetable earth, are combustible, and leave goshs light ashes. Under this order there is one genus, viz., the fchifus, or fclay,
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flate, including thirteen species, among which the most distinguished are the table-flate, black flate, blue house-flate, and black crayon.

2. The calcareae, or calcareous flones, which originate from calcareous marine animal bodies, become light and porous in the fire, and fall into an impalpable powder, and effervesce, and are soluble in acids, unless they are previously saturated with an acid, as the gypsum. This order comprehends four genera, viz. marble, of which there are fifteen species, such as the black flaty marble, the Parian marble, and all its varieties; the Florentine marble, the white grain lime-flone, the faly lime-flone, &c.; gypsum, or platter-flone, of which there are three species, such as the common plaster, alabaster, &c.; flint, or fibrous alabaster, including four species, as the fibrous gypsum, or English talc, &c.; and jasper, or spar, of which there are fourteen species, some soluble in aqua fortis, as the soft spar, refracting spar, or illand crystal, subdiaphanous compacta spar of different colours, pellucid coloured spar, as foplar topaz, emerald, and faphire, &c.; and some not soluble in aqua fortis, as the fossil spar.

3. The argillaceae, or argilaceous flones, which originate from the silicified sediment of the sea, are somewhat unctuous to the touch, and hardened in the fire. To this order belong three genera, viz. talcum, or foap-earth, including twelve species, as the ruddle, fialith, or French chalk, or foap-earth, fapent-flone, and hornblende, &c.; amathus, or earth-flax, of which there are ten species, as the asbestus, plumeof asbestus, mountain cork, and aluta, or mountain leather, &c.; and mica, or talc, of which there are ten species, as Mufcoy glass, gold glimmer, and green talc, &c.

4. The arenite, or sand-flones, which originate from the precipitation of rain-water, are extremely hard, strike fire with ease, and by trituration, yield a very rough powder. This order comprehends three genera, viz. the cos, or whetstone, of which there are seven species, as the gronite, filtering-flone, mill-flone, building-flone, &c.; the quarts, including eight species, as the pellucid rock quartz, coloured rock quartz, red, blue, yellow, &c. milky quartz, granulated quartz, pebble quartz, &c.; and the fleas, or Flint, of which there are sixteen species, some being vague or loose flints, as the common flint, gun-flint, Egyptian pebble or Mocoa-flone, opal, onyx, or cameo, chalcedony, cornelian, &c.; and some being rock-flints, as the agate, petroflex or chert, jasper, &c.

5. The argilaceous rock or compound flones, which originate from a mixture of the four preceding orders variously conglutinated; the interfaces, usually filled up with quartz, spar, or glimmer. Of this order there is only one genus, viz. the saxum, or rock-flone, including thirty-nine species, as the porphyry of different colours, the trapassum, or trap-flone, the granite, the fubrum, or founder's-flone, the filicinium, or pudding-flone, &c.

The second class of fossil bodies are the minere, or minerals, which Linnaeus defines to be fossil bodies originating from a saline principle by crystallization; they are command, as consisting of a base, united with saline, inflammable, or metallic principles; and they are soluble, perfectly, in an appropriate menstruum; of these there are three orders, viz.

1. Salis, salts, or crystals, which are rapid bodies soluble in water; distinguished from each other by their different effects on the organs of taste: under this order there are six genera, viz. nitre, of which there are nine species, as the salin, or native salt-petre; the quartzofe, or mountain crystal; fluor, or coloured crystal, from the varieties of which are the true byacinth, the fale topaz, ruby, emathyb, sapphire, beryl, and emerald; and the calcareous, as the hexagonal truncated spars, the fulillum, or sparry fine-flone, &c.; natron, including fourteen species, as the salin, or native mineral alkali, sapphireum, and Epsom salt; the lapidofe, or spatofe, decadedrous natron, the gyppic, pellucid, fuliform natron, the feltenis, or rhombic natron, the byodon, or pyramidal, or dog-tooth spars, &c.; borax, of which there are six species, as the saline, or tincal, or native borax; the lapidofe, to which belongs the gemma nobilis, or lapidofe, prismatic, pellucid borax, with truncated pyramids, and as varieties of this species, the yellow or topaz, the pale green or chrysolite, the sea-green or beryl, and the deep green or emerald, the bafatines, the tournaisin, the garnet, and the margodes, or opaque, argilaceous, tessellated borax; the maris, or sea-flate, of which there are nine species, as the salin, or sea-flate, fountain, and hot-bath salt; the lapidofe, or Bononian flone, sparry fluor, or Derbyshire spar, &c.; aluïm, or alum, including fix species, as the native, or native alum, plumofe, &c.; soluble, or auum-flone, flone-alum, or calcareous alum-flone, called Roman alun; and lapidofe, to which belong the lapatofe alun, or siala amethysty, the gemma, pretiosa, or diamond, ruby, and sapphire, &c.; vitriolium, or vitriol, of which there are eight species, as the simple, or thole of iron, of copper, and of zinc; the compound, or picro-vitril, or vitriol, of which there are ten species, as the chalybeate, or iron vitriol, or vitriol, &c.; and the lapidofe or spatofe vitriol of zinc.

2. Sulphurae, or inflammable bodies, flaming and odorous when burning; soluble in oil, and distinguished from each other by their different effects on the organs of smell; of this order there are five genera, viz. ambra, or ambergris, including two species, as the grey and the brown; fucillum, or amber, of which there is one species, as the electric amber, and the varieties of diaphanous, opaque, yellow, brown, and that which includes infusions; bitumen, of which there are ten species, as the naphtha, petroleum, or rock-oil, maltha, or Jews' pitch, mumin, or feum minerals, alphaltum, or fossil pitch, ampelette, or peat, lithanthrax, or common coal, or schilfofe bitumen, gaggas, or jet, fulillum, or calcareous fetid bitumen, of which there are the varieties of compact, granulated, squamofe, and crystalline, and the hepaticum, or liver bitumen; pyrites, or sulphurs, including seven species, as native sulphur, opirniment, crystallized pyrites, or marcasite, figured pyrites, iron pyrites, copper pyrites, of which there are four species, as the dark aquline, and liver-coloured pyrites; and arsenes, comprehending eight species, as the solid tenebricus, or arsenic, the fandarcha, or red arsenic, mineralized with sulphur; the arsenical marcasite, the arsenicum albicans, or arsenic mineralized with iron, &c.

3. Metallae, or metals, which are shining heavy bodies, fubbish in the fire, and soluble in appropriated acid menstrua; distinguished from each other by inspection: of this order there are two subdivisions, into semi-metals not malleable, and metals malleable. The first subdivision includes two genera, viz. hydargyrum, or mercury, of which there are five species, as virgin, or native quicksilver, cubic crystallized quicksilver, cinabarin, with the varieties of lamellated, granulated, and crystallized, and pyrrhicol, cuprosus, stone mercury, &c.; molycidanum, or wad, or black-lead, of which there are three species, as plumago, or black-lead, or wad, or sulphur faturated with iron and tin, manganasia, or black manganese, and fopma lupi, or red manganese, or wolram; fibrum, or antimony, of which there are four species, such as native regulus of antimony, crystallized fibrum, fibrous, lapidofe, or common antimony, and red antimony; mineralized with fulillum, or arsenic; of which there are eight species, as crystallized zinc, that mineralized with sulphur.
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Sulphur and lead, or iron, that mineralized with sulphuretted iron, fibroze zinc, calcamine, or stone zinc, or zinc mixed with martial ochre, blind or mock-lead, or black jack, or semi-tuffellated black zinc, and red zinc, or micaceous liver-coloured zinc: *bijmuum*, or bismuth, of which there are four species, as native bismuth, common bismuth, mineralized with sulphur and arsenic, mural, bismuth, and bismuth mineralized with sulphur only: and *cobalt*, of which there are four species, as crystallized cobalt with sulphur, arsenic, and cobalt mineralized with arsenic and iron, pyritico cobalt and flag-cobalt.

The second subdivision comprehends malleable metals, and of these there are fix genera, *vix. flammum*, or tin, including four species, as crystallized tin or tin-grains, tin-boat, *flatace*, or tin, of which there are ten species, as native lead, cubic lead crystallized, cubic lead mineralized with sulphuretted silver, or galena, filiated lead-ore, greenish arcanical lead-ore, sparry arcanical lead-ore, &c.: *ferrum*, or iron, including twenty-seven species, as native iron, in grains, crystallized iron, such as obey the magnet, to which is added the denomination by part: another iron-ore, fine-grained iron-ore, common iron-ore, pyritico iron-ore, talcy iron-ore, calcareous iron-ore, emery, &c.: such as do not obey the magnet, of which there are red micaceous iron-ore, blood-iron, red blood-iron, spars-like iron-ore, &c. for the magnetic, or the magnet: *copper*, or copper, of which there are sixteen species, as copper precipitated upon iron, native copper, crystallized octahedral copper, pyritico yellowish-green copper-ore, pyritico purple copper-ore, soft pyritico grey copper-ore, footy, pyritico arcanical copper-ore, white arcanical, pyritico copper-ore, indurated ochreous red copper-ore, which is sometimes liver-coloured; sandy ochreous copper-boat, green and blue copper-boat, lapis lazuli, lapis armenius, or blue calcareous copper-boat, malachite, or green gyphoeus copper-boat, nickel, or copper mineralized with sulphur, arsenic, and iron, &c.: *argentum*, or silver, of which there are nine species, as native silver in various forms, horn silver-ore thinning, submalleable, and somewhat diaphanous, mineralized with sulphur and arsenic, glass silver-ore, or lead-coloured malleable silver-ore, mineralized with sulphur, red silver-ore mineralized with sulphur and arsenic, white silver-ore mineralized with arsenic, copper, and sulphur, grey silver-ore mineralized with sulphur, antimony, copper, and iron, silver-ore mineralized with arsenic and iron, silver-ore mineralized with sulphur and zinc, and footy silver-ore mineralized with arsenic and copper; and *aurum*, or gold, of which there are two species, as native gold, found in various forms, as in thin plates or leaves, solid, or in thick pieces, and a crystalline form; it is also found imbedded in quartz, talc, and sinnabar, and in rivers in loose grains and lumps, called gold-dust; and mineralized pyritic gold-ore.

The third clafs are fossils, which are bodies originating from different modifications of the subject comprehended in the preceding classes: of these there are three orders, *vix.*

1. *Petrificador*, or such fossil bodies as represent in figure certain animals or vegetables, or parts of them. The true petrifications are such as have the texture and organic parts of the bodies entirely filled up with fowy paricles, either of a calcareous or flinty, and sometimes marcellific nature: there are others in which the bodies are preferred and unaltered, as having left only the animal gluten: others, again, are only bodies incrusted with flatace, or calcareous matter: and frequently they are only impressions received in their soft state. Of this order there are eight genera, *vix. zeolitites*, or the petrifications of mammalies, including four species, as bones of men, remains of the rein-deer, foal, ivory, and turquois, or teeth jointed by copper: *orniticolites*, or petrifications of birds, in whole or in part, and of their nests, of which the first species are scarce, and are usually alacritical incrustations: *amphibolites*, or petrifications of amphibias, of which there are fix species, as of an entire tortoise, of a toad, of the skeleton of a crocodile, of an entire serpent, of various nates, as of the rana, bull-fish, &c., and glosseopes, or shark's teeth: *sibbolidites*, or petrifications of fishes, including three species, as those of entire skeletons, with the fins in state, and in marble, and the bufonites, or grinding teeth of the wolf-fish: *entomo-olites*, or petrifications of insects, including three species, as the cancri or petrified crab, lobster, &c. paradoxus, or unknown insect, petrified, and insecta inclosed in amber, which indeed are not proper petrifications: *belminolites*, or petrifications of worms, including twenty-four species, as the corn ammonis, orthcocerates, or straight nautilus; ano- nites, as the various anoma, gryphites, or crown-foam; Jew's *flatace*, supposed to be spines of echinites, madreporas of various kinds, entrochus, flata-foones, sleemantes, &c.; *physolites*, or petrifications of plants, of which there are seven species, as of the entire plant in coal-flate, of ferns in state, of roots in marble, of wood in various flates, as of lime- stone, agate, flint, sand-foone, and state; of leaves in state and marble, of flowers in state, and of fruits in coal first, commonly cones of the pise, nuts, acorns, &c.: *grapto- lites*, or foones resembling pictures, including eight species, among which are Florentine marble or flate, resembling ruins; dendrites, representing woods, landscapes, &c. arising from vitrioic solutions inflatuated between the plates of fittle foones, or in marble.

2. *Concreta*, which are flight conglutinations of different kinds of earths, whose specific differences arise principally from the nature of the component parts: of this order there are fix genera, *vix. calculi*, or animal concritions, including eight species, as the flone in the kidney, or bladder: tartar of the teeth, of the lungs; *bezoar-foone*, formed in the abomasus, or fourth stomach of ruminating animals; *tophite*, or impurities of various kinds, formed in the heart-foone, the bones, pearls, and crab's eyes: *tartari*, of vegetable concritions, of which there are two species, as yeal, and red and white tartar: *setites*, or concritions within the cavity of foones, of which there are the true, having a loose nucleus, as the geodes with an earthy nucleus, and the aquilines with a flomy nucleus; and the spurious, as the haemachates, or flinty setites, with a fixed crystalline nucleus, marble *setites*, including dog-tooth spar, and echinated setites, including fluor crystals: *pumice*, or concreitions by means of fire, including eight species, such as black flatte pumice, white pumice of iron-furnaces, red copper pumice, foot, ashes of volcanoes, Rhenish mill-foone, vitreous pumice, or black and green Iceland agate, &c.: *flataceites*, or concritions by means of air, including twelve species, as vegetable incrustations, drop-foone, solid and branched marmoreous flatace, solid flatace, red flatace, zeolite, &c.: and *topbus*, or concreitions in water, including twenty-two species, of which there are the metallic tophes, as the marly toph-foone, the tubular, merry, ochaceous topbus-foone, the sandy ochaceous fes topbus-foone, the brown iron-ore in various forms, &c.; and the simple tophes, as alum toph, concritions of tea-kettles, pea-foone of hot springs, oesocolla, or bone-binder, solid black schisto toph, &c.

3. *Terra*, or earths, which are fossile substances not conglutinated, but usually in a slightly cohering or pulverized state;
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State: of this order there are five genera, viz. ochra, or ochres, or earths of metals, of which there are fifteen species, some in the form of powder, as ochre of iron, green and blue ochres of copper, native ceras, ochre of cobalt, &c.; and others plumocele, or germinating ochres, as copper blue, or plumocele copper, flowers of antimony, plumocele bismuth, with sulphureted antimony and arsenic. &c. : areno, or sands, including fourteen species, as sea-fand, coloured sands, sand of heaths, fabulum, or common sand, micaceous, or glittering or writing sand; gold, iron, and frit sand, &c. : argilla, or clays, boles, and marles, including twenty-one species, some simple, among which are porcelain clay, tobacco-pipe clay, China porcelain earth, Lennian earth, fuller’s earth, tripoli, or rotten stone, brick-clay, potters’ clay, boles of different colour, &c. ; others mixed, as fermenting clay, marle, umbre, marle of the Nile, &c. : calx, or chalk, comprehending nine species, some soluble in acids, as creta or chalk, mineral agaric, shell-chalk, or mouldered shells, &c. ; some not soluble in acids, as true mineral agaric, gypteous gur, or lac lune; and others granulated or sandy, as alabaster, chalk, soluble arenaceous calx of the isle of Ascension, and lenticular granulated calx; and humus, or mould, of which there are fourteen species, as the impalpable vegetable mould, common black mould, depauperated mould of heaths, spongy mould of marshes, alpine earth, turf, mould of lakes, or mud mould, red mould, animal mould, &c. See Linnet Systema Naturae, tom. iii. 1770, pa. 881; and Pullesey’s General View of the Writings of Linnaeus, 1781, p. 151—166.

M. Da Costa, in his Natural History of Fossil, 1757, distinguishes stones into four general classes. The first class comprehends those stones which are found forming continued strata, coarse, hard, and rough, of a lax texture, of a visible grit or grain, resembling sand in form, usually immersed in a cementitious matter, of little brightness, and scarcely capable of any polish: of this class there are two genera, viz. stones hard and rough, composed of a visible grit, not of a laminated structure, and splitting equally in any direction, called psadoria by Hill, of which there are the alkaline sand-stones, as the Portland-stone, free-stone, &c. ; sand-stones not acting on acids, as the whetstone, altrum, mill-stone, grind-stone, &c. ; and sand-stones imperfectly described by authors; and stones harsh and rough, composed of a visible grit, of a laminated structure, and splitting only horizontally, or into plates. See Flag. See also each stone respectively.

The second class comprehends stones that are found forming continued strata, of a close, solid, smooth texture, or composed of no visible grit, and generally defective of brightness, though in some degree capable of a polish: of this class there are two genera, viz. stones of a close solid texture, of a plain uniform structure, and splitting with equal ease in any direction, distributed, according to their colours, into black, white, ash, and grey, red, brown, blue, green, and variegated, each of which is again subdivided into alkaline stones, and those which are not acted upon by acids, comprehending the Purbeck-stone, oil-stone, &c. and stones called clates.

The third class comprehends marbles and marmoroide.

The fourth class includes the marmoro-profera, the granites, and the porphyries. See Fossils.

For an account of the modern systems of geology, see Rock, Strata, and System of Geology.

In the sequel of this article, we shall consider stone as applicable to architecture and sculpture.

Stone for Architecture and Sculpture. The application of stone to the construction of houses, appears to have been almost coeval with the establishment of civilized societies. The advantages which stone possesses over wood, in hardness, strength, and its capability of refining the action of fire, would naturally direct those tribes or nations that resided in countries where stone was plentiful, to employ it in architecture. Thus we find in America, where the human race was in its rudest state, no sooner were men collected in large bodies, under the kings of Mexico and Peru, than they began to build houses of stone.

In Assyria, where one of the first great monarchies was founded, the people were deprived of the use of stone, the ground being formed to a great depth of alluvial soil brought down by the rivers Tigris and Euphrates. To overcome this difficulty, they made artificial stones, by baking square masses of clay in the sun. Bricks formed in this, or in any other manner, are properly artificial stones, and have been formerly used to supply the absence of natural stone, by the Egyptians, the Assyrians, and the Romans, as well as by the moderns.

In the choice of different stones for public or private edifices, the contiguity of certain stones, and the ease with which they could be obtained and worked, would be first attended to, particularly in the early periods of architectural science: but there cannot be a doubt that durability and beauty were soon regarded as essential qualities of buildings, and those stones which possessed these properties in a remarkable degree, were sought for with great avidity, and conveyed to distant countries at a great expense.

Such was the care of the ancients to provide durable materials for their public edifices, that, had it not been for the defolating hands of modern barbarians, and the inevitable destruction attendant on warfare, many of the temples and other public works of the Greeks and Romans would have remained perfect to the present day, uninjured by the action of the elements during a period of more than 3000 years.

On the contrary, in modern Europe, and particularly in Great Britain, there is scarcely a public building of recent date which will be in existence a thousand years, hence. Many of the most splendid works of modern architecture are hastening to decay, in what may be justly called the very infancy of their existence, if compared with the date of public buildings that remain in Italy, in Greece, in Egypt, and the East. This is remarkably the case with the three bridges of London, Westminster, and Blackfriars, the foundation of which began speedily and visibly to perish in the very lifetime of their founders. The same observation is applicable to Somerset-house, and many other public buildings in London; the fine chiselling of the alto relievo figures having already disappeared by the action of the elements mouldering away the stone. The most careless observer may notice, that this effect is more rapidly taking place in some stones than in others in each of these buildings, though they are all of Portland stone, a calcareous stone, called roe-stone by mineralogists, and obtained from the Isle of Portland.

We have reason to know, that very little attention was paid to the selection of the stones during the building of Somerset-house; and the damaged ones, or those which contained hollows lined with clay, were not rejected, but the hollows were filled up with mortar. No soft calcareous stone, such as Portland stone, can be very durable in a climate like that of England, where it must be exposed to the action of frequent rain; and for the foundation of bridges, scarcely any stone could be more unfit.

The qualities requisite for building-stone in bridges or water-works, are hardness, tensility, and compactness, with the
the property of refilling the decomposing effects of water
and the atmosphere. Beside the strength necessary to sup-
port their own weight in such buildings, they may also
have to refit the impetus of floating bodies, and particularly
of large masses of ice. Tho' flowers which are the hardest,
are not precisely those which have the most tenacity or
toughness, of which we have a familiar illustration in com-
mon lime-stone and glass; the latter, though much harder,
is far more easily flintable than the former.

In public national buildings, intended to preserve the
memory of the ages in which they were constructed, and to
perpetuate the state of the arts at the period of their erec-
tion, beside the properties which ensure durability, we
require a certain degree of beauty in the stone itself.

The causes that accelerate the decay and destruction of
stone in buildings, are nearly the same with those which oc-
casion the destruction or wear of rocks on the surface of the
globe: they may be class'd into two kinds, those of de-
composition, and those of disintegration. By the former,
a chemical change is effected in the stone itself; by the
latter, a mechanical division and separation of its parts.

The decomposition takes place, when the stone contains
parts that are more or less soluble in water, or which enter
into combination with oxygen or acids. To have a distinct
idea of the decomposition of stones, we must first consider
the elementary parts of which they are composed: these
are either siliceous, aluminate, or limey. (See Silice, Alum-
inate, and Lime.) to which we may add magnesian, which, though
of more rare occurrence, enters largely into the composition
of serpentine and some lime-stones. Iron, in different states
of oxidation, and in different proportions, enters also into
the composition of almost all stones, and is frequently an
important agent in their decomposition. The different
kinds of building-stones may, therefore, be class'd as si-
laceous, argillaceous, calcareous, and magnesian.

Of these, the siliceous are the least liable to decomposi-
tion; silice being insoluble in water, or any of the acids, except
the fluorine, which is never found in a large portion of stone,
and composed almost entirely of silice, if compact, may be con-
sidered as the most durable; but they are frequently brittle,
and extremely difficult to work. When the stone is com-
bined with a certain portion of alumine, as in some horn-
stone and jasper, it constitutes a stone which may be re-
garded as imperishable, when compared with the duration of
stones and empires. Such stones frequently contain im-
bedded crystals of quartz and felspar, and are then deno-
minated porphyries. Porphyry, with a compact siliceous
base of hornstone or jasper, is far more durable than granite,
and is peculiarly appropriate for columns or obelisks, de-
tined to transmit the events of former times to distant ages
of the world. Some porphyries are also very beautiful, and
take a high polish.

Granite (see Granite) is a compound siliceous rock,
which varies much in the proportion of its constituent parts;
and its degrees of induration. Compared with many rocks,
granite may be considered as forming a durable building-
stone; but those granites that contain much white felspar,
and only a small proportion of quartz, like the greater part of
the granites of Cornwall and Devonshire, are liable to de-
composition and disintegration much sooner than many of
the Scotch granites, in which the quartz is more abundantly
and equally disseminated. In the selection of granite in
Cornwall and Devonshire, the preference is given to that
which can be raised in the largest blocks, and worked with
the greatest ease; and for common purposes, or for paving
stones, it may answer very well; but for the foundations
and piers of bridges, the harder granite will be found much
more durable. The present state of Cornwall proves the
rapid disintegration and decay of its granite rocks. The
felspar in that granite contains a large portion of potash, and
to this its more rapid decomposition may be principally
ascribed. The naval hospital of Plymouth (an establish-
ment which does honour to the country) is built of Cornish
or Devonshire granite, which appears to have been well
selected. It has been erected about 70 years, and exhibits
no symptoms of decay, except in the columns forming the
colonnade in front of each building; here, on their expo-
red sides, we have observed the felspar to be disinte-
grating, and lichens have already attached their roots to
some parts of the surface.

With granite may be class'd all granitic rocks containing
a large portion of siliceous earth, particularly sienite. (See Sienite.) This rock was extensively quarried by the
Egyptians at Sienna, in Upper Egypt, and afterwards by the
Romans; and many works constructed of this stone, pre-
serve the marks of the chisel fresh to the present day.

Of the rocks here enumerated, we have abundance in various
parts of the British empire; and in the construction of na-
tional works, the selection of the stone should not be left to
the discretion of architects, few of whom have made mine-
ralogy any part of their studies. Many of the sand-stones,
in what are called the secondary strata, are composed of
grains of silex; and where these are united by a siliceous
cement, they are almost as durable as granite. In siliceous
sand-stones, the coarnees or angles of the grains is of far
less importance than the substance by which they are united.
Those which are united by ferruginous clay, are very liable
to perish by exposure to the atmosphere. Some siliceous
sand-stones appear to be of alluvial formation, and have
their parts so loosely cemented, that they are quite unfit for
architecture: such is the sand-stone rock on which the town
and castle of Nottingham are built.

In the series of strata which alternate with coal, there are considerable beds of silici-
aceous sand-stone, which vary much in their quality; some being
almost pure, others being almost purely siliceous. Of the latter kind are some of the
lowest beds in Yorkshire and Derbyshire, which have been
denominated mill-stone grit, being formerly used for coarse
mill-stones. Kirkstall abbey, near Leeds, is built of this
stone: it is now a ruin, but the stones which remain are
perfect, and preserve their angular sharpness as fresh
as if they had been recently worked, though six hun-
dred years have elapsed since the erection of this building.

There is a quarry of similar stone in the neighbourhood
of Wakefield, extensively worked at present. It may be proper to ob-
serve, that in all quarries of sand-stone, the first stone vary con-
siderably in their power of resisting the effects of the
atmosphere. Some strata are marked with frits and veins,
and these are frequently found to be more perishable than
the general mass of the stone. We have known such stones
preferred for the fronts of buildings, on account of their
fupposed beauty; but, in the course of a very few years,
the coloured parts began rapidly to decay, by the action
of water on the iron, which these parts contain more abun-
dantly than the rest of the stone. From what has been
stated, it may be seen that stones, which are purely siliceous,
are of all others the least liable to decomposition; but where
there is an admixture of silex with different substances, great
skill is required in their selection for durable architecture.
Some directions for the choice of such stones will be subse-
quently given.

Argillaceous stones, or those which contain in their com-
position a considerable portion of clay, are generally found
to contain also a large portion of iron. This metal appears
to have a greater affinity for argil or clay than for any other earth, and is frequently combined with argillaceous flints in the proportion of one-fourth of the whole mass. The iron is frequently in the state of black oxyd, and in this state rapidly combines with a larger portion of oxygen, when exposed to the atmosphere, and thus occasiona the surface of the stone to swell and shiver away. We have seen flint of this kind in their native beds, some hundred feet under the surface, so extremely hard that they refilied the point of a pick, and could only be removed by blastig; yet when the same flint was exposed for some months to the air, it became soft, and shivered into small pieces.

It rarely happens that builders or engineers have sufficient mineralogical science, to enable them to anticipate the changes which will be effected by air and moisture on the materials they felect. The lofs which this ignorance has occasioned in the construction of many public works is well known. A remarkable instance of this kind took place a few years since in Paris. A gentleman was walking with an eminent mineralogist in one of the newly erected public edifices. They were particularly struck with the appearance of the walls, some large columns that supported the roof. On a closer inspection, the mineralogist predicted that they would perish in less than three years. About ten months afterwards, the gentleman had occasion to pass through the same building, and observed workmen were then removing the columns, and replacing them with a different flint; the decay having been so rapid, as to render their removal necessary.

In forming the tunnel of the Huddersfield canal, in Yorkshire, through Pule Mofis, a lofty mountain three miles in breadth, the workmen, in one part, had to cut through a dark argillaceous flint, so extremely hard, that they were obliged to remove it by blasting. On account of its hardness and compactness, it was deemed unnecessary to wall the passage in the part which was cut through this bed; but in a few months after the access of air, it shivered and fell in, and the removal and repair occasioned much delay and expense. Many bafaltic rocks, which are almost as hard as flint in their native beds, on exposure to air or moisture, are soon covered with a brown incrustation, which penetrates deeper and deeper into the flint till the whole is reduced to a soft pulvulent mass: this is occasioned by the rapid absorption of oxygen, the iron in the bafalt being in a low state of oxygenation.

On this account, bafaltic flint are ill suited for durable architecture, though there are some flint of these clays which appear more perfectly vitrified, and reflect the action of the atmosphere for ages. This is also the case with lavoas which are nearly allied to bafalt: some lavoas rapidly decompose and form a fertile soil, others remain unchanged for centuries. In all flint called argillaceous, the quantity of alumine, or pure clay, is, in fact, generally less than that of the other earths. Alumine or clay, when pure, is soft and unctuous, and absorbs more than 2:4 times its own weight of water. It communicates, in a greater or less degree, its own properties to flint, where it is combined in the proportion of from 30 to 30 per cent. The properties of clay are lost by vitrification, or by exposure to a strong heat, as we may observe in the process of brick-making. In the West Riding of Yorkshire, it is frequently the practice to mend the roads with argillaceous flint, but it is soon reduced to mud, to prevent which, it is piled in heaps, with alternate layers of coal, and burned before it is laid upon the roads: this makes it more durable, but the heat is seldom sufficiently powerful to vitrify the flint, and the roads frequently want repair. The remains of vitrified forts in some parts of Scotland, prove that the North Britons were acquainted with the durability imparted to argillaceous flint by exposure to great heat. In situations at a great distance from the durable building-flint, it would be advantageous to have the bricks employed in the construction of bridges exposed to a greater degree of heat, and vitrified on the surface. This may be more easily effected by a mixture of calcareous earth with the clay.

Calcareous flint includes all the different kinds of lime-flint, from the most crystalline marble, to chalk and calcareous sand-flint. Of marbles, there is an almost infinite variety; indeed every variety of lime-flint that admits of a good polish is denominated marble. (See Marble.) The lime-flint or marbles that occur in primitive mountains, among blocks of granite, gneiss, and mica-flate, are generally the most durable, as they are highly crystalline; and many of them contain a considerable portion of siliceous earth, which communicates a greater degree of hardness to such marble. Though calcareous earth is in a certain degree soluble in water and carbonic acid, yet in its most indurated state, as in primitive marbles, the action of the atmosphere produces no change in the course of centuries; but when exposed to the constant action of water, the decomposition is more rapid. Those marbles which are the most uniform in their texture, which possess the greatest degree of specific gravity and hardness, and which will receive the highest polish, are those which will prove the most durable. There is another test applicable to marbles, and all flint purely calcareous, which affords no bad proof of their durability.

Let all weight of different marbles be cut into cubes, or any other regular figures, and immerse in dilute muriatic acid of the same degree of strength as marble which dissolves most slowly, will be the least liable to decay.

Some lime-flints confit of calcareous earth, combined with a considerable portion of magnesia: the primitive lime-flints which contain this earth have a milky whiteneis. All lime-flints of this kind dissolve very slowly in acids; and such of them as polishe the other properties of hardneis, and an uniform texture, may be considered as the most durable of all marbles. The importance of an uniform texture is evidenced in the different durability of the Parian and the Penticelic marbles. They were both extensively employed by the sculptors and architects of ancient Greece. In the age of Pericles, the preference was given to the latter. The Parthenon was built entirely of marble from mount Pentelicus (Penticelic marble), near Athens. Many of the Athenian statues, and the temples of Ceres or Eleusis, were of this marble. The preference arose from its superior whiteneis, and probably from its vicinity to Athens. It is remarked by Dr. Clarke (Travels, vol. iii.), that while the works executed in Parian marble remain perfect, those of Pentelic marble have been decomposed, and sometimes exhibit a surface as earthy and rude as common lime-flint. This is principally owing to veins of extraneous substanies which intersect the Penticelic quarries, and which appear more or less in all the works executed in this kind of flint. The Parian marble has some of what appears to be a waxy appearance when polished; it hardens by exposure to the air; it receives with accuracy the most delicate touches of the chisel, which it retains for ages, with the mild lustre of the original polish. The Medicean Venus, the Diana Venatrix, the colossal Minerva (called Palladi of Veletas), and the statues of the Capitolins, are of Parian marble. The Parian tables at Oxford are also of this flint. The marbles of South Britain, those of Devonshire are by far the most beautiful; for the Anglesea marble, as it is called, is principally pure serpentine (see Serpentine); though it is called by professor Jameson,
STONE.

In the late edition of his Mineralogy, with granular lime-tone. The Devonshire marbles have scarcely been noticed by mineralogists, but many of them possess a degree of beauty scarcely inferior to any of the foreign marbles, particularly those of Babicomb. They are veined and spotted with a variety of colours, from a bright red to a beautiful dove-colour, and are susceptible of a very high polish. The altar, and the interior of Lord Clifford’s elegant chapel at Ugbrooke, near Chudleigh, are executed in this marble, which may vie with the most costly marbles of Greece or Italy. The great national work called the Break-Water, at Plymouth, is formed of blocks of Devonshire marble: it is an artificial mole of vast extent, intended to form a bay, where our largest fleets may ride in safety. The marble is procured at Cat Down quarries, close to the water’s edge, from whence it is conveyed in boats about two miles, and thrown into the sea. The blocks are raised of vast dimensions by blasting, and from their hardness and size may exhibit the decomposing effects of sea-water for ages, particularly if the western side should get a covering of sand. The continuity of the flone necessarily determined the choice where some million tons were wanting to complete the work, but there cannot be a doubt that the granite of Cornwall would have made a more durable barrier.

Among the secondary lime-flones, there are some which contain a considerable quantity of magnesia, particularly in the counties of Nottingham, York, and Durham. These lime-flones have generally a yellowish colour: they diffuse slowly in acids, and form a very durable flone for architecture. York Minster is said to be built of this flone.

The roc-flone, particularly that of Portland and Bath, is very extensively employed in architecture: it can be worked with great ease, and has a light and beautiful appearance; but it is porous, and poissies no great durability, and should not be employed where there is much carved or ornamental work, for the fine chiselling is soon effaced by the action of the atmosphere. On account of the ease and cheapness with which it can be carved, it is much used by our English architects, who appear to have little regard for futurity.

The chapel of Henry VII. affords a lamentable proof of the want of the architect to the choice of the flone. All the beautiful ornamental work of the exterior had mouldered away in the short comparative period of three hundred years: it has recently been caved with a new front of Bath flone, in which the carving has been correctly copied; but from the nature of the flone, we may predict that its duration will not be longer than that of the original. Probably the architect was limited by contract, which precluded the use of a more durable, but more costly flone. Portland, as well as Bath flone, varies much in its quality, and we think greater attention was paid to its to the chiselling in the construction of St. Paul’s church, than in many of the modern edifices built of this flone. Though we have observed many flones in the upper part of the building mouldering away, yet, on the whole, it is less injured by the weather than Somerset-house. In buildings constructed of this flone, we may frequently observe some of the flones nearly black, and others presenting a white clean surface. The black flones are those which are more compact and durable, and prefer their coating of smoke: the white flones are decomposing, and presenting a fresh surface, as if they had been recently scraped. This effect is strikingly exhibited in the columns of Somerset-house, in which black and white flones may be seen alternating in the same column.

Some of the lower beds of chalk are occasionally used for building-flone, though, from its loose texture, it cannot possess great durability. We have seen the cloisters of Wellminster Abbey repaired with a flone of this kind, so soft as to yield to the nail; and on inquiring of the workmen why they made use of such a material? the reply was, “the cheapness of the cutting.”

Alabaster or gypsum is sometimes employed for ornamental architecture. The name alabaster is also given to stalactitical lime-flone. (See Stalacite.) This variety of lime-flone poissies nearly all the properties of granular lime-flone. The gypsum alabaster is a sulphate of lime, and possesses a considerable degree of solubility in water. Dr. Watfson, in his Chemical Essays, states, that he suspended two ounces of this flone in a pail of water forty-eight hours, changing the water several times, and found at the end of that time it had lost one-thirtieth part of its weight. From the solubility of gypsum, it is obviously improper for any purpose where it is to be exposed to the action of rain or water.

Of the magnesian flones, there is only one applicable to purposes of architecture; this is serpentine, which has been fully described under that article.

The disintegrating causes to which building-flones are exposed are moisture, variation of temperature, and vegetation: the action of these is distinct from that of decomposition. The earths which are not soluble in water are capable of being mechanically suspended in it, when minutely divided. A drop of water, constantly running along the hardest flone, marks its path by cutting a furrow in the surface, according to the well-known adage:

“Gutta caveat lapidem non vi sed saepe cadendo.”

This cause is, however, flow, compared with others which are constantly operating. Water inulmates itself into the minute pores and crevices of flones, and being expanded by variation of temperature, and particularly by froth, breaks, and, under the hardest flone, or shivers off a portion of the surface. Those flones which have a laminated structure are more liable to be injured by the effects of froth, from the facility with which water inulmates itself between the laminae.

Lichens and mosses fix their roots on the surface of flones, particularly on those argilaceous flones which yield an earthy smell, when breathed upon. By inulminating their roots, they accelerate the decay of such flones, and prepare a vegetable mould for plants of a larger growth.

In calcareous and other sand-flones, where the cementing material is of a soft kind, it is washed out by rain, and the flone falls in pieces, or moulders away. In general, those flones which are the most hard, compact, and uniform, in their texture, and which can be brought to the smoothest surface, are those least liable to disintegration. In order to form a judgment of the durability of any building-flone, which has not had the test of experience, it is desirable to examine it in its native bed, particularly those parts of the bed which have been long exposed to the air. This may not unfrequently be done in some part of the country where the flone is quarried; for as each stratum rises in a certain direction, it will come to the surface somewhere, if not covered by foil. The flone, in such situations, offers certain indications of the effect which atmospheric agency produces upon it. Where this examination cannot be made, all flones that are not calcareous may be in some degree proved, by observing what effect is produced by immersing them in water for a given time, by exposing them to a red heat, and to froth, or by covering them with dilute nitric acid for several days. Those flones which absorb the smallest quantity of water, and which are least changed by the
the action of heat, frost, or acids, may be fairly considered as most capable of refilling the decomposing or dilute-grating effects of moisture and change of temperature. We have before suggested a test in the choice of calcareous stones. It has recently been the practice to rub the calcareous sand-stones with oil; and this must to a certain degree refit the absorption of water, and contribute to the durability of the stone.

Foreigners generally class building-stones into two kinds, hard and soft. In the latter they comprise all stones that can be cut with the faw in any direction, and with some degree of ease: the hard stones are all those which cannot be worked by the same process. In England, the name free-stone is given to all the softer stones, which can be cut easily with the faw into large blocks suited for building-stone: it includes a variety of sand-stones very different in their nature.

Experience has taught our architects, that all stratified stones lay much longer, when laid in the same direction which they had in their native quarries; a circumstance which ought always to be attended to by the master. As stratified stones generally split with the greatest ease in the direction parallel with the surface of the strata, it is obvious that they will bear less pressure in this direction than in a line perpendicular to their natural position.

The following table shows the value at Rome of marbles, alabaster, and hard stones, regulated by the cubic Roman palm, which is about nine inches in each dimension. The fciudo, which contains one hundred bajacchi, is about 4. 6d. English.

Marbles.

<table>
<thead>
<tr>
<th>Stone Description</th>
<th>Value (Sc. baj.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marmo bianco di Carrara</td>
<td>0 70</td>
</tr>
<tr>
<td>Greco</td>
<td>0 90</td>
</tr>
<tr>
<td>Nero di Carrara</td>
<td>2 0</td>
</tr>
<tr>
<td>Antico, detto vulgaramente di paragne</td>
<td>8 0</td>
</tr>
<tr>
<td>Giallo di Sienna</td>
<td>2 50</td>
</tr>
<tr>
<td>Detto Porta Santa, antico</td>
<td>2 0</td>
</tr>
<tr>
<td>Detto Fior de Perlino antico</td>
<td>1 40</td>
</tr>
<tr>
<td>Detto Settebaffi femplice antico</td>
<td>2 0</td>
</tr>
<tr>
<td>A rosa antico</td>
<td>8 0</td>
</tr>
<tr>
<td>Giallo antico</td>
<td>7 0</td>
</tr>
<tr>
<td>Verde antico (of fine quality)</td>
<td>15 0</td>
</tr>
<tr>
<td>Dito in large mafies</td>
<td>20 0</td>
</tr>
<tr>
<td>Rallo antico</td>
<td>12 0</td>
</tr>
<tr>
<td>Dito in large mafies, very scarce</td>
<td>24 0</td>
</tr>
<tr>
<td>Africano</td>
<td>1 50</td>
</tr>
<tr>
<td>Cipolino</td>
<td>0 60</td>
</tr>
<tr>
<td>Bianco e nero antico</td>
<td>30 0</td>
</tr>
<tr>
<td>Delle cofte di Francia</td>
<td>8 0</td>
</tr>
<tr>
<td>Di Polcevera</td>
<td>3 50</td>
</tr>
<tr>
<td>Verde Prato</td>
<td>3 0</td>
</tr>
<tr>
<td>Porto Venere con macchie gialle</td>
<td>2 50</td>
</tr>
<tr>
<td>Breccia corallina antica</td>
<td>5 0</td>
</tr>
<tr>
<td>Di Saravezza</td>
<td>2 50</td>
</tr>
<tr>
<td>Di Francia</td>
<td>0 50</td>
</tr>
</tbody>
</table>

The term antico, like oriental in gems, sometimes implies only a beautiful stone.

Alabasters.

<table>
<thead>
<tr>
<th>Stone Description</th>
<th>Value (Sc. baj.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabastro di Montalto</td>
<td>3 0</td>
</tr>
<tr>
<td>d'Orte bianco</td>
<td>6 0</td>
</tr>
<tr>
<td>Rosato del sasso della Penna</td>
<td>25 0</td>
</tr>
</tbody>
</table>

Hard Stones.

<table>
<thead>
<tr>
<th>Stone Description</th>
<th>Value (Sc. baj.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granito roso delle guglie</td>
<td>0 50</td>
</tr>
<tr>
<td>Ditto in great mafies</td>
<td>3 0</td>
</tr>
<tr>
<td>Egitano nero con macchie bianche rossigne</td>
<td>3 0</td>
</tr>
<tr>
<td>Bianco e nero antico</td>
<td>8 0</td>
</tr>
<tr>
<td>Porta ritrico, detto porfido roso</td>
<td>8 0</td>
</tr>
<tr>
<td>Ditto in large mafies</td>
<td>12 0</td>
</tr>
<tr>
<td>Pralino, detto porfido verde</td>
<td>8 0</td>
</tr>
<tr>
<td>Ditto in great mafies, scarce</td>
<td>15 0</td>
</tr>
<tr>
<td>Rosato</td>
<td>6 0</td>
</tr>
<tr>
<td>Granitone bianco e verde</td>
<td>6 0</td>
</tr>
<tr>
<td>Granitello</td>
<td>0 50</td>
</tr>
<tr>
<td>Bafalste nero d'Egitto</td>
<td>10 0</td>
</tr>
<tr>
<td>Oriental verde</td>
<td>20 0</td>
</tr>
<tr>
<td>Verde di Membi, vulgarmente detto serpantino</td>
<td>3 0</td>
</tr>
<tr>
<td>Antico</td>
<td>0 50</td>
</tr>
<tr>
<td>Breccia d'Egitto di fondo verdeno</td>
<td>8 0</td>
</tr>
</tbody>
</table>

The prices of the above stones are enhanced not only by their size, but by any extraordinary beauty of colour which each specimen may possess.

STONE, in Agriculture. It is a point not yet determined, whether stones are hurtful or beneficial to arable lands. Examples are not wanting on both sides of the question, though, in general, it seems rather to be carried for them. However, nothing can excuse leaving a stone in any ground so large as to interrupt the plough. If they are very large, they should be blown to pieces with gunpowder, and then be carried off. Some spots, very fertile in several kinds of grain, seem to consist of nothing but stones; and instances are given of fields being rendered barren, by taking away the stones which covered them. Theophrastus accounted for this in a hot country, where it happened to the Corinthians, by saying that the stones sheltered the earth from the scorching heat of the sun, and thereby preserved its moisture. The same holds true even in our colder latitude, where the heat of the sun is lefs apt to hurt us. And Evelyn is clearly of opinion, that husbandmen rather impoverish than improve those grounds which are almost covered with stones, especially where corn is sown, if they pick them off too minutely: because they thereby expose the land too much to the effects of heat and cold. Certain it is, that a moderate mixture of small gravel prefers the earth both warm and loofe, and prevents too sudden exhilarations. But it seems highly probable that there must be some farther reason, beyond what has been yet asigned, for the benefit arising from the stones.

However, the concealed stones should be always removed from lands that are to be kept in a state of tillage, otherwise many accidents must happen in ploughing, by the straining and breaking of the ploughs, and the destruction of other implements. And where the lands require underdraining, it may often be proper and beneficial, as well as a cheap method, to have the stones made use of, and gathered from the ground; and by such means, two objects may be accomplished at once. See Clearing of Land, and Draining of Land. See also SPRING and SURFACE Draining.
STONE.

In some places it is met with a few inches under the surface, like a clove pavement. In whatever position or size these stones inlet the land, it is there the prevailing opinion, that until it shall have been in some measure cleared, by digging, or ploughing and picking, little hopes of succcess can be entertained, even from the best modes of cultivation; although instances of the contrary may sometimes be produced. Lands have been cleared of this stone, by screening the whole masts of flinty matter and earth as deep as the yellow clayey under-earthen, in the same manner as masons screen the sandy materials for their mortar, with very great success and advantage, though at much expense. The refuse stones, in this or other ways, are purchased at one shilling the load from the farmers, for their use in repairing the roads. The round cobble stones, picked from the land, are much used in the south of Lancashire, and probably in some other places, for paving the roads.

Whatever may be the cause of the productivity of tillage-lands, so bet with loose round stones as scarcely to have any appearance of earthy matter or mould amongst them, the writer of this article has over and over again seen vast crops of different sorts of excellent grain produced on such land. See STONY LAWN.

STONE, as to the Origin and Formation of, M. Tournefort, on his return from the East, in the year 1702, proposed to the Royal Academy a new theory.

On a curious survey of the famous labyrinth of Crete, he observed, that several people had engraved their names in the living rock, of which its walls are formed; and what was very extraordinary, the letters whereof they confided, instead of being hollow, as they must have been at first, (being all cut with knife-points,) were prominent, and stood out from the surface of the rock, like so many baflo-reliefs.

This, he says, is a phenomenon no otherwise accountable for, than by supposing the letters of the letters filled individually with a matter issuing from out of the subsidence of the rock, and which even if used in greater abundance than was necessary for filling the cavity. Thus, the wound made by the knife healed up, much as the fracture of a broken bone is consolidated by a callus, formed of the extravasated nutritious juice, which rises above the surface of the bone: and this resemblance is the more just, as the matter of the letters was found whitish, and the rock itself greyish.

Something very like it is observed in the banks of trees, in which letters have been cut with the knife; so that the poet had reason to say, that the characters grew as the trees themselves grew: "Crepitent illae: creceptis amores." M. Tournefort supports his opinion by similar calluses apparently formed in several other stones, which had re-united after, by accident, they had been broken.

From these observations, he says, it follows, that there are stones which grow in the quarries, and of conformation that are fed; that the same juice which nourisheth them, serves to rejoin their parts when broken; just as in the bones of the animal animal. And this branch of the science, when kept up by handagers, and in a word, that they vegetate.

There is then, says he, no room to doubt but that they are organized; or that they draw their nutritious juice from the earth. This juice must be first filtered and prepared in their surface; which may be here esteemed as a kind of bark, and hence it must be conveyed to all the other parts.

It is highly probable, that the juice which filled the cavities of the letters, was brought thither from the bottom of the roots; nor is there any more difficulty in conceiving this, than in comprehending bow the sap should pass from the roots of our largest oaks to the very extremities of their highest branches.

It must be owned, that the heart of these trees is exceedingly hard; and yet those of Brazil, called iron-wood, guaiacum, and ebon, are much harder. Coral is as hard in the sea as out of it; and sea-mushrooms, which every body allows to grow, are true stones, and fo, like the common stones, are used in America to make lime.

Some stones, then, he concludes, must be allowed to vegetate and grow like plants. But this is not all: he adds, that probably they are generated in the same manner; at least, that there are abundance of stones, whose generation is inconceivable, without supposing that they come from a kind of seeds, in which the organic parts of the stones are wrapped up in little; as those of the largest plants are in their seeds.

The stones called Cornu Ammonis, Lapis Ludovici, of Verona, thofe of Bologna and Florence, the several kinds of pyrites, crystals of the rock, and an infinity of other stones, he supposes to have their several seeds: as much as mushrooms, truffles, and various kinds of mosses, whose seeds were a long time before they were discovered.

He continues, how should the cornu Ammonis, which is constantly in figure of a volute, be formed without a feed? Can it be that same figure in little? who moulded it so artfully? and where are the moulds? Far from this, these kinds of stones are found in the earth, like common flints. Nor were either their moulds, or any thing like them, ever discovered.

M. Tournefort examines the several kinds of stones above mentioned, and finds them under the same necessity of feed. Again, that immense quantity of pebbles, with which the Crou of Arles is covered, he thinks a strong argument in behalf of this theory.

The country there, for twenty miles round, is full of round rough pebbles; which are still found in equal abundance, to whatever depth you dig. M. Pierefo, who first propounded the generation of stones by means of feeds, (though he took the word feed in a very different sense from M. Tournefort,) first brought this extraordinary collection of them as a proof of it. In effect, how could so many similar pebbles be formed? There is no saying they are coeval with the world, without asserting, at the same time, that all the stones in the earth were produced at once; which were to go directly contrary to the observations above mentioned.

Among the seeds of stones, M. Tournefort observes, there are some which do not only grow soft by the juices of the earth, but even become liquid. These, then, if they penetrate the pores of certain bodies, grow hard, petritify, and assume the figure or impression of the body: thus, what we call fæuntites, concubites, myrtulites, ofractites, nautulites, echinolites, &c. are real stones, the liquid seeds of which have infinuated into the cavities of the shells called fæten, cuhbus, myrtus, ofra, nautus, and echinus. On the contrary, if these liquid seeds fall on flints, on shells, sand, &c. they enclose the several bodies, and, animating between these forms, kind of cement, which yet grows like other stones. It is highly probable, that such rocks as are only an assemblage of cemented flints, have been formed by a number of these liquid seeds; in like manner as the quaries full of shell: unless the rocks have enveloped these bodies in their growth.

He even supposes, that there are seeds of real stones enclosed in the spawn of certain shell-fish; as well as that hard solid matter defined for the forming their shells.

There is, says he, a particular kind of shell-fish, called ...
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Pholas, which are never found any where but in the cavities of flints, which are always found exactly fitted to receive them. Now, it is highly improbable the first should come and dig such a notch to spawn in: it is much more likely, that the flones they are found enclosed in were at first soft; and that the matter of which they are formed, was originally found in the spawn, in like manner as the matter which forms the egg-shell is really found in the seed thereof.

From the whole he concludes, that the seed of flones, and even of metals, is a kind of dust which probably falls from them while they are alive, i.e. while they continue to vegetate as above. This dust may be compared to the seeds of several plants, which no microscope ever yet discovered; though their existence is not at all to be doubted.

Probably, flints and pebbles are among flones; for it is a notion new: Pliny affirms us, that Theocharitus and Mithridates believed, that flones produced flones: and Gregory Nazianzen adds, that there were authors who even believed, that flones made love, &c. &c. &c. De Virg.

All this, however, is founded on the imperfect knowledge of those times.

Since M. Tournefort’s days, we have discovered other ways of formation for the lapis Judaeicus and corum Ammonis; the first being only a petrifaction of the spines of echinus marinus, and the other of a shell-fish nearly allied to the nautilus kind. See fossil, Judaeicus Lapis, and Cornu Ammonis.

M. Geoffroy accounts for the origin and formation of flones in a different manner. He lays it down as a principle, that all flones, without exception, have been fluid; or at least a soft paste, now dried and hardened; witness the flones in which are found foreign bodies; witness also figured flones, &c.

On this principle, he examines the formation of the different kinds of flones; and shews, that the earth alone suffices for the fame, independent of all flaks, sulphurs, &c. The metallic particles contained in flites give them their colour; but these are only accidents: for proof of which, he inflects the faphylites and emeralds of Axerigne, which lobe all their colour by a moderate fire consuming their metallic parts; but without any damage to their transparency; they being hereby rendered mere crysals.

To view rock-crystal, indeed, one would not take it for earth; and yet earth it must be, not water congealed, as the ancients imagined.

M. Geoffroy conceives two kinds of primitive particles in the earth. Thole of the first kind are exceedingly fine, thin lamelles, equal to each other, or nearly so. Now, when these meet together, from any cause whatever, in a sufficient quantity, the regularity and equality of their figures determine them to range themselves equally and regularly; and thus to form an homogeneous compound, which is very hard, from the immediate contact of the parts; and very transparent, by reason of their regular disposition, which leaves a free passage to the rays of light every where; and this is crysital.

The parts of the second kind have all sorts of irregular figures, and make accordingly form assemblages that are much more opaque, and less hard. Now crysital is formed wholly of parts of the first kind; and all other flones of a mixture of the two kinds of parts together: this mixture is absolutely necessary, in order to unite and bind together the parts of the second kind, and give them a hardness and consistence, without which they would only make a sand or dust. Water now appears the fittest vehicle to carry the parts of the first kind. This is seen from several petrifying springs, which incrustate the pipes through which their water is conveyed, or even solid bodies laid in them for some time. The water does not dissolve those earthy parts; it only keeps them in fusion, as it does the juices with which plants are fed.

This water, thus charged with earthy particles of the first kind, M. Geoffroy calls the fomy, or crystalline juice, of which those bodies are primarily formed. See Crystal.

Some look upon flones as unorganized vegetables, and that they grow by the accretion of flaks, which often shoot into angular and regular figures. This, it is said, appears in the formation of crysals on the Alps; and that flones are formed by the simple attraction and accretion of flaks, appears by the tar tar on the sides of a clarret-velvet, and especially by the formation of a fome in the human body. Henkel has thrown together some very ingenious thoughts on this abstruse subject, in a treatise published in the year 1734, where he builds no opinions on any other basis than that of facts, observations of nature, and experiments.

He supposes that the earth was at first every where soft on the surface, and that this soft matter by degrees hardened, and formed flones of several kinds. He seems to imagine, that the surface of the earth was a second time all reduced to this soft state by the universal deluge at the time of Noah, and that this matter afterwards hardening into flones of various kinds, included the shells of sea-fishes, and other animal remains of the produce of the seas, in flints, in lime-flone, or in whatever other substance the matter, among which they lay, chance cowden.

Thus may the sea-shells, found finely in the middle of hard flints, or lodged in vast numbers in the infra of earth, lime-flone, or marble, be accounted for.

Nor is water alone the agent that may have made these changes in the once soft parts of the earth’s surface; we can by fire reduce the poorest earths into a sort of glafs, a hard transparent body, not a little resembling the nature of flint, or the other semi-pelleucid flites. Fire is of power to do great things in the bowels of the earth, and the way to learn what changes it may there make in flones, is to try its effect upon the several different kinds of flones and earths here.

By experiments of this kind we learn, that of the several species of flones in their present state, some are reduced to a friable mass, and finally to powder, by the force of fire; others are hardened by it; others are melted, and become a kind of glafs: and by experiments on the other sullflue substances, it appears that the original matter of all flones has been earth, either of the nature of chalk, marble, or clay; and that many of them have been greatly altered by receiving metallic or other mineral matter into their earthly matter, at the time of their formation; and all seem to have owed their change into their hard state, either to fire alone, or to saline, oily, metallic, or saline sulphureous matters, either conjunctly with the force of this agent, or alone. Henkel, Lithogenes.

Thole flones which are formed in their present state, immediately out of fluids, have been produced either by congelation, a rude coalition, or crystalization; and that all the gems have been once fluid is plain, from their imperfections in certain instances, as from their containing grains of sand, or the like extraneous substancess, firmly embodied in them. If these, the hardeft of all flones, have been once fluid, there is no reason to dispute, but that all the other kinds may have been so, which are lefs hard and lefs perfect. For the formation of flones, according to modern systems of geology, see Rock, Strata, and System of Geology.

Stones, Formed, among Naturalists, mineral, or fomy matter,
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matter, cast in the cavities of certain sea-shells, or other parts of marine animals.

Of these, some are found quite naked and bare; others have the remainder of the shell about them; and among these there are also found many real shells, scarcely at all altered from their recent state, buried at great depths in the earth, far from seas, and even on the tops of mountains.

This is by most supposed an effect of the general deluge, and by many is thought a convincing proof of the truth of that history; but there have been many who have affirmed, that these bodies can convey no such proof, since, as they affirm, they are not, nor ever were, marine animals, or owed their form to such, but mere lyellus natures, shells formed in the places where they are found, having no relation to animals of any kind, but only accidentally resembling them. But the adherents of the former opinion have rather the better side of the argument.

It seems, indeed, contrary to the great wisdom of nature, which is, in all its productions, to design every thing to some determinate end, that these bodies should have been so nicely formed by a mere plastic virtue in the earth, or endured with all the characters and necessary parts of animal covering, &c. for no other end but merely to exhibit such a form, without having any relation to the uses these particulars are appropriated to in the animal. But if the origin of shells, found in the shape of shells, be doubtful, yet the real shells found in the earth cannot be supposed to have been formed there: yet these are found at so great distances from the sea, and not only in the low grounds and hillocks, but in the highest parts of the loftiest mountains, even without the least particle of fleshy matter about them; mere shells unpetrified, uncorrupted, and of the exact figure, structure, and confidence of the sea-shells, which are now habitations of living animals of the same species.

That nature should form real shells, without ever intending them for the sovereing of an animal, seems no way probable; and indeed, were it true, would give great strength to the atheist's opinion, that all things existed by mere chance, and were intended for no end or use. Nor are the shells the only influences of these fossil bodies perfectly resembling animal ones, but we find with them other parts of animals, as the teeth of fishes and land animals; which, though met with buried in earth, or on the tops of mountains, are plainly the same with the substanaces produced by the fishes, &c. Of this kind are the teeth of the several species of sharks, called quires, those of the wolf-fish, called ceblis, and the like.

The very inspection is abundantly sufficient to prove, that these were once parts of animals; but were that insufficient, they have not, even in this their fossil state, so far divested themselves of their animal nature, but that they carry proofs of it; and Columna has evidently proved their true origin from these. He observes, that all animal and vegetable substanaces, whether of a woody, bony, or fleshy nature, by burning, are changed first into a coal, before they go into a calx of ashes; whereas fleshy substances, on the contrary, do not burn into a coal, but are reduced at once into their calx or lime, or else into glafs. But these teeth, supposed by some mere productions of the earth, all burn first into a coal, while the fleshy matter adhering to them does not; whence alone it is sufficiently plain, that they and that substance are of very different kinds, and that they are truly of a bony, not a fleshy nature. It is also repugnant to that great maxim, that nature does nothing in vain, to suppose these teeth formed in the earth where they are now found, since they could there have no use as teeth, nor the vertebra, or other bones, as bones. It is very certain, that nature never made teeth without a jaw, nor shells without an animal inhabitant, nor bones without the rest of the body they belong to; these things are not made in this separate and uselesse state in the element to which they naturally belong, much les in a form in which they are not usefull, or one.

Their very substanace and place also evince plainly, that they were not formed where they are now deposited, for they are usually lodged in stones, and stones contain not the matter of which they are made: and as to their place, they might have been lodged there either when formed, which proves our assertion, or else they must have been at some time generated all of a sudden there, or have grown from a small origin, increasing by little and little, as the animal substanaces which they resemble do. Now, if the fleshy, in which they lie, was formed before them, and they were formed on a sudden in it, how came the cavity there just to correspond to their size? and if they grew by little and little, how could they form a cavity in the stone, without bursting or cracking it?

It is also no small proof of these teeth being of a marine or animal origin, that they are not regularly shaped at the bafe, but are all broken, and that in various manners, which proves very plainly, that there has been no vegetation in the case, because in all other figured fossils they are never found mutilated or imperfect. It cannot, with any shew of reason, be supposed that these teeth were thus broken within the body of the stone where they now lie, but it is plain that they were lodged in the stone at a time when it was soft, and were before that broken off from the jaw of the creature in this irregular manner.

It is likewise no weak argument, that these bodies are not formed at this time in the stone, that they are all found perfectly alike; for, if they were continually increasing in size and number, it is probable that the new formed ones would be some way different from those which were of older date. The variety of species in the glossopetrae alone may evince, that they belong to the animal to which they are attributed, since they are of very different kinds. See Glossopetrae, and Serpentes Tongues.

The perfection of the figures of these bodies is a farther proof of their origin from animals which they reprent, since in all crystallizations there are many imperfect and mutilated figures, nay more than perfect ones.

To all this it may also be added, as an unanswerable proof of the fossil shells having been marine, and having lived in the sea, that these shells are found with injuries which could have been no way else received. The perfect animal, and some other shell-fishes, have bony tongues, with which they bore regular holes through the shells of shell-fish of other kinds, in order to make their way in, and prey upon their flesh. These holes are always easily known by their regularity and shape; and shells bored through in this manner are not only frequent on our shores, but there are such also found fossil, bedded in the strata of earth or fone; and surely, if falls could be allowed to have shot into the figures of real shells, they could never be suppos'd able to shoot into the figures of such wounds, as a few of those shells have received in their recent state from other animals.

The general opinion is, that the deluge brought all these shells into the places where we see them; but this seems not easily conceived; and as there is no argument so good, but that being carried too far it will make against its purpose, fo the laying too much to the effects of the general deluge, has made many believe it has done nothing at all.

These formed stones and real shells are both found in vast strata on the tops of the highest mountains, the Alps, Apennines,
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Apennines, and others in different parts of the world. The deluge lasted only ten months, and probably the tops of mountains were not covered half that time; and these immense quantities of shells cannot be supposed either to have bred there in that time, or to have been carried so high in such prodigious numbers. It is more probable that the tops of mountains were once not high, but bottoms of the sea. The history of the marine bodies they contain is then very plain, and earthquakes may have raised them, or they may indeed not be so high above the level of the sea, as we at first sight suppose. If, indeed, we adhere to the letter of the text, in the Scripture history of the creation, we can find no account for these bodies from that time; for if the creation of fishes succeeded the separation of the land from the water in all parts of the globe, they could not be then deposited there; but it is possible, that at the creation the whole earth was not all at once uncovered, but only those parts where Adam and the animals were created, and the rest gradually afterwards, perhaps not in many years, as there seems no necessity of understanding the account of the creation to have been in fix natural days. If we may thus understand, and conjecture in this respect, it is not difficult to conceive, that during the years in which the earth remained covered with sea-water, shell-fish might breed and multiply abundantly all over its bottom; and this bottom being afterwards elevated, deflected by the sea, and made dry lands, these shells must be elevated with it, and retained in thofe flat Beds, which afterwards hardened into the various kinds of earth and stone: and something of this kind seems to have been the cause, much rather than, according to Dr. Woodward, that all stony matter should have been dissolved by the deluge, and afterwards have concreted again. Ray's Physico-theological Discourses. For other hypothesis and observations relating to this subject, see Adventitious Fossils, Marine Remains, Petrifications, Seminum, and Shells.

STONES, Solutions and Colours of. The various beauties of the form and colour of the several more precious stones, cannot have been always the admiration of the curious part of the world, and the ingenuity of the ablest chemists hath been tried, in attempting to counterfeit them; and much may be gathered even from their attempts, which have not succeeded, toward the learning of the true nature and history of these beautiful bodies.

The beautiful figures of the Florentine marble, whose veins represent trees, rivers, and ruins of buildings, are well known; as are also the delineations of trees and shrubs in those species of white agates, called Moos agates. All the stones of this kind are natural, for art has yet not been able to come up to any counterfeit of them; but it is not so in regard to those agates which represent regular figures of beasts, &c. there are all ablast by art, and that by a very simple and easy process; and M. Du Fay, in the Memoirs of the Paris Academy, has given at one view the several ways, then known, to penetrate into the substances of agate, marble, &c. and to lodge figures in them.

The stones subject to be figured, divides into two classes, the harder and the softer. Of the harder kind, are those which reftit the force of acids, even of the most powerful kind, and of this class are agates, onyxes, and all that are vulgarly comprehended under the general name of the gems, or precious stones, with crystal, porphyry, granite. These, and the like stones, are not soluble in any of the known acids, yet these fame acids, impregnated with the solutions of metals, are capable of penetrating very deeply into them, and tingling them with different colours.

The simple agates and jaspers, and other stones of the like uniform structure, are easily coloured in an uniform manner; but those which are variegated with veins are composed of several different sorts of matter, and therefore are less easily, and less evenly stained. As the tinging matter does not penetrate the several beds, or veins, in the same manner, therefore, all that can be done to these, is to add spots and veins to their natural ones, but they cannot be tinged throughout to one uniform colour, as the chalcedony or white agate may.

If a small quantity of a solution of silver in spirit of nitre be poured upon one of these agates, and the stone exposed to the sun, it will in a few hours be tinged to a reddish-brown colour; and if more of the same solution be added, and it be again exposed, the colour will become stronger, and will penetrate deeper into the body of the stone; and if the stone be not too thick (e.g. more than a fifth part of an inch), and the solution be rubbed on both sides, it will tinge it throughout. Nor is this all the effect, for it will give it several veins and lineations, which were not distinguishable in it before; the reason of which is, that in all these stones there are some parts harder than the rest, and consequentlly more difficultly coloured, and these remaining, therefore, paler than the rest of the mals, make the lines and veins in it.

If there be added to the solution of silver, used for this purpose, a fourth part of its quantity of foot, and as much of tartar, the colour becomes grey; and if, instead of this foot and tartar, the same quantity of plumebo alum be used, the stone will be tinged to a deep violet colour, tending to black. A solution of gold gives agate only a pale brown colour, and that penetrates but a little way into it; and a solution of bismuth gives a colour, which appears white when the light falls directly upon it, but brown when it is held against the fun-hine, or a candle; and all the metallic and mineral solutions, employed in the same manner, affect the stone more or less in the same manner.

The expatting of the stones to the sun is a very necessary article in the process, since without that the tinge is but very faint, and penetrates but to a very little depth. To trace in the chalcedony, or white agate, figures of any determinate kind, the usual method is this: before the stone is polished, mark out the intended figure with the point of a fine needle, and afterwards with a brush, or a pen, follow those lines with a very strong solution of silver.

One would imagine that the dendrite, or delineations of trees in Moos agates, might be imitated in this manner; but it is difficult to give the due blackness of colour, and to mark the figures with a like precision and exactness. See AGATES.

If any stone should, however, be suspected to be adulterated, or counterfeited in this manner, it is easily brought to the trial; for if it be thus made, a small heat over the fire will almost entirely divest it of its colour, and the rubbing a little spirit of nitre or aqua fortis over it will have the same effect. In both cases the stone may, however, be refretted again to its beauty: in the firft, by tingling it anew with the same liquor, and in the latter, by only exposing it for several days to the sun.

It is well known, that by means of fire alone the amethyst, the sapphire, and the other gems, may also be wholly divested of their beautiful colours. The method of doing this is, to put the gems into a crucible, surrounding them with sand, or with reel-fillings; then putting them into the fire, they lose their colour as they become hot, and are taken out wholly colourless. If the white agate be calcined in this manner alone, it becomes of a cloudy or opaque white.
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white; but if it has before been stained with the solution of silver, those spots or flaws become of a yellow colour, which aqua fortis afterwards has no power to take away. If the agate be calcined first, and afterwards rubbed over with the solution of silver, it receives some spots and lines of brown. The cornelian loses a great part of its redness by calcination, and becomes of a dusky flesh-coloured white; and the corococox fume, treated in the same manner, loses all its colour, and the delineations disappar of two or three places.

There are many stones on which the solution of silver has no effect; of this number are all the gems, rock crysral, and the like. The dendrites of Catalonia is also of this kind; and of this stone the artificers relate an odd phenomenon, which is, that if it be fawn under there is very few delineations observed in it, but if it be split by a blow, it is usually found full of them. The reason of this is only that these delineations are so many flaws and cracks, and the stone breaks easiest in these places.

The effect of the solution of silver is different, as to degree of colour, on different stones. The oriental agate receives from it a deeper and blacken tinge than the common chalcedony. Some agates, naturally distinguished by their yellow spots, receive a purple colour from it. The jade stone, used by the Turks, takes only a faint tinged of brown. The common prime emerald, or root of the emerald, becomes blacker with it. The oriental granite is tinged in many places with a violet colour by it; this is principally effected in the white parts. The solution does not act much on the black ones, only that it takes some of them away. The serpentine marble receives an olive colour from it; but it is remarkable that the amathustes, and the talcs, and other foliaceous stones, are wholly unaffected by it.

There is another method of staining some stones of a colour more truly black than that which the solution of silver communicates to most of them, and with this farther difference, that the colour being produced by fire, has not been destroyed (says Dr. Lewis) either by moderate fire or by aqua fortis. Pieces of different stones, marbles, pebbles, flint, &c. may be rubbed together with a saturated solution of copper made in aqua fortis; when dry, let them be put into a crucible, and kept for a little time in a fire just sufficient to make the vessel almoost red hot. All of them will be thus stained in the parts moistened with the solution of a black colour, durable, and very deep, though it penetrated only a very little way into the substance of the stone.

Dr. Lewis fuscets, from some experiments on the solution of silver applied to different substances, which he has mentioned (Phil. Com. of Arts, p. 350;) that this solution stains stones only in virtue of their containing a calcareous earth, or such an earth as the acids is capable of dissolving: if this be the case, there is no wonder that some of the hard stones should be stained, and some of the soft unaffected by it.

Marble being a substance much softer than agate, receives the colours with much greater ease, and the doing of this in an accurate manner has been the subject of the attempts of many eminent men.

Kircher has given some directions for the staining of marble, which have been translated word for word in the Philosophical Transactions; but they are so indeterminate and uncertain, that nothing can in reality be learned from them. See Colouring of Marble.

Many others have written also on the same subject, but M. Du Fay is the only one whose experiments are plainly and clearly laid down, and may be followed by any body.

This gentleman chose the common white marble without veins for making his experiments, for the same reason that he chose the plain agates, because in the veined ones there are several different sorts of matter, all of which are not to be penetrated with equal ease. The solution of silver penetrates into marble to the depth of an inch, or more, and gives a tinge, reddish or purple at first, and afterwards brown, from which colour it never varies afterwards. It always takes off the polishing by the marble, eating away a part of its surface. The solution of gold does not penetrate so deeply into marble as that of silver, but it gives a beautiful violet colour.

Both these operations are much afflicted by exposing the marble to the sun. The liquors usually diffuse themselves, and spread every way in the marble, so that it is not easy to make any figure with them that shall keep its outline tolerably regular. And this imperfection appears to the lefs, according as the solution is the more satured, so as to dry or crystallize the more speedily. An easy method of avoiding this inconvenience, says Dr. Lewis, is fuggated by the practice of the engraver; for the means, by which he confines the aqua fortis on his copper-plates to the minutest strokes, would doubtless answer the same intention here. The surface of the stone being coated with a proper tenacious substanse, which the acid cannot act upon, as the composition called etching-wax, which consists of refrinos fluids melted with wax, or boiled with oil to a due consistence; and the drawing being made in this ground, so that each stroke may reach down to the stone, it may be presumed that the solution of silver, afterwards applied, will go no where spread farther than the parts thus laid bare. See Colouring of Marble.

The solution of copper gives marble a beautiful green tinge, but it does not penetrate deep, and on the application of boiling water becomes black; when the surface is polished off afterwards, however, it becomes again of a beautiful green. Beside the powerful acidic menfrums, there are many other liquors which have a power of penetrating deep into marble. Of this nature are all the oily fluids; but the exprest oils have this disadvantage, that they leave a satins in the marble which will not suffer it afterwards to take a good polish.

All substances which can penetrate marble, can carry colours into it; but such are most eligible, which having lodged the colours, evaporate, and leave them there, without injuring the stone. Spirit of wine is of this number; it is excellently qualified for the extracting of beautiful tinctures, and links them very deep. Oil of turpentine also has its value, but it does not take tinges so well as the spirit. Some have recommended lixiviums of the first alkaline falls, but they very rarely produce any beautiful colour. In the using of these fluids the marble is to be gently heated, and the spirit is by that means evaporated before it is cooled, leaving its colour always behind.

White wax penetrates very deep into hot marble, and conveys colours into it in a very beautiful and determinate manner. There are, however, but few bodies, which will impart their colours to wax, and therefore this valuable means is of a very limited use.

Several of the gums alone are also able to tinge marble very strongly. Dragon's blood, and gamboge, if rubbed on hot marble, penetrate to the depth of about a twelfth of an inch; the gamboge requires the marble to be hotter than the other, and tinges it to a very beautiful yellow; the dragon's blood tinges to a red in different degrees, according to the heat of the marble.

If these gums have been used to polish marble, there is no farther caution necessary than the cleaning them off.
STONE.

from the surface with a little spirit of wine: but the way to make them sink deeper into the stone, is to take off the polish by rubbing the surface with pumice, or the like, and then the gums sink much farther, and the colours appear very beautiful when the marble is polished again.

Though these gums act alone, yet they will succeed much better if diffused in spirit of wine, and applied with a pencil; for by this means they sink deeper in, and the figures traced out will keep their determinate form and outlines, these solutions of ink, fixing immediately, without spreading any way. It is also remarkable, that the solution of dragon's blood hardens the marble, and renders it less soluble in acids than before; so that if a piece, stained in part with this solution, be afterwards rubbed over with an acid dissolvent, and its surface eaten away to some depth, the parts which are coloured will all stand out above the rest. A tinture of Brazil wood in spirit of wine tinges marble red; and if the heat given to the marble be greater, it becomes purple: but both these colours fade a little in keeping. A tinture of cochineal gives a purplish-red; and the more the oil is heated, the farther the colour penetrates, and the deeper it is.

In oil of turpentine, the colour of cochineal penetrates much deeper into the marble, but it has a brownish cast. Alkanet root, by means of spirit of wine, gives also a red colour, which, if the heat be too great, changes to brown; and this, and most other of the like matters, tinge the marble, in tinture with spirit, to a flight depth; and in oil of turpentine they sink much deeper, but then the oil leaves a greatly appearance upon the marble.

If verdigris be boiled a considerable time in white wax, it tinges marble, when rubbed hot upon it, to a beautiful green, little inferior to that of the coarser emeralds, and the colour spreads itself very equally, and penetrates to a third of an inch deep; if the marble be made too hot, the colour becomes that of the jadé-stone. Alkanet boiled in white wax gives a flesh colour, which penetrates very deep; and the roucou boiled in wax makes a permanent yellow, which also sinks very deep. The best way of heating marble for this purpose is to lay the piece, intended to be stained, upon a bed of sand, a foot of an inch deep, upon an iron plate; this is to be set over the fire, and when of a proper degree of heat, the colour is to be applied. The just degree can only be found by experience, and it varies indeed in almost every colour; but, in general, the finer colours require the marble to be of such a heat, that the hand can just bear to be laid upon it, and the others require a somewhat greater degree than this.

Black is, of all colours, the most difficult to be given in this manner to marble; and perhaps, indeed, it is impossible to impart that colour in any degree of perfection; and that for this plain reason, that all these colours only fill the interstices between the granules of the marble, those granules themselves remaining unaltered; thus, in the other colours, the whiteness of the granules is only a heightening to the tinge, making it brighter, and a little paler; but the whites can never fail to appear distinguishingly as such in black, and by that means destroy that colour.

Dr. Lewis observes, that he has stained the porous marbles, which admit water to sink into them, of a full black colour with china ink, other by applying on the warm marble an ink already made, or by the alternate application of astringent liquors and solutions of iron; but with the more compact marbles this method did not succeed, though they were heated so far as to make the liquors boil upon them; however, by a solution of copper, managed as above related, and by a solution of the metallic part of cobalt in aqua regia, employed in the same manner, the most compact pieces were stained black; though the process requires too great a heat to be practiced on marble without danger of injuring the stone. The colour which solutions of gold communicate to marble, in its deep shades, obtained by repeated applications of the solution, approaches very near to black.

Next to black, blue seems the most difficult, of all the colours, to be given to marble. M. Du Fay, however, having found, by M. Geoffroy, experiments, that oil of the thyme, by long fusing with spirit of sal ammoniac, acquired a blue colour, tried this mixture, and found it succeed very beautifully; but this is one of those colours which require the marble to have but a very small degree of heat, since a greater would evaporate them before the colour had time to penetrate.

When the oil of thyme is digested with the volatile spirit, it becomes first yellow, then red, then violet, and at last of a deep blue. In six weeks' digestion it had acquired a pale blue, and in this state gave little colour to marble: after standing for six months, it was distilled almost to a black hue, and being now applied on warm marble, gave the stain defiled. M. Du Fay also stained marble of a blue colour with tinture of archel. The tinture of it in water is applied on cold marble, and renewed as it evaporates, till the colour is sufficiently deep. He says, that he few pieces of marble thus stained, which in two years were not feebly changed.

The colours of the gums may be laid on when the marble is cold; and on heating it afterwards, they will sink into it. See Colouring of Marble.

There is another very elegant sort of workmanship to be performed on marble, that is, the tracing of figures in relief in it; and this is done much more easily than might be imagined, there being nothing more required to it, than the faving of the parts which are to be left in relief, by covering them with a varnish, and eating away the rest by means of an acid. For this purpose, let the designed figures be traced in chalk upon the marble, and cover them with a varnish, made by dissolving a piece of common red sealing-wax in spirit of wine; then pour on the marble a mixture of equal parts of spirit of salt and distilled vinegar, and this will eat down all the ground, and leave the figures standing, as if engraved with immense trouble. The adding of the colours before described, to these marbles afterwards, in a regular manner, will give them a surprising beauty. Mem. Acad. Par. 1728 and 1732. Lewis's Phil. Com. of Arts, p. 436, &c.

Mr. Müller, in graining some aurum fulminans, made by dissolving gold in aqua regia, and precipitating it with salt of tartar, together with some red glas powdered, and a little water added, found that this mixture stained the onyx, or chalcedony, of which the mortar was made. He was rubbing this mixture together to make an enamel colour, and leaving it three or four days in this little mortar, he found, that not only where it had been rubbed against the bottom of the mortar, but where it had accidentally splashed against the sides of it, and on the surface of the pellet, it had tinged them both very deeply to a fine red, leaving the intermediate parts without, or as it were, onyx, or chalcedony colour, wholly unaltered. The polish of the stone was not injured in the places where it was thus stained, nor could any art get out the colour, though it was tried with alkalis and other sharp liquors. This colour was not given to these parts of the stone of the mortar in simple blotches, but formed itself into regular lines, as we see the natural colours.
of stones do; but this not in the same degree of colour, but some of the lines were deeper, others paler.

This experiment was repeated in several other mortars of the same stone, but without success; on which the stones, of which they were composed, were examined with the help of glasses, and it was found that this mortar chanced to be made of a more flaky chalcedony than any of the others; though it appeared equally solid and beautiful to the naked eye, and bore a polish no way inferior to them. It may be worth while, on this occasion, strictly to examine stones of this chalcedony kind, and on meeting with a plate of one of them of this flaky kind, to cover it with this mixture, and by that means give it a series of lines, which must make it a very beautiful and valuable stone. The polish will not be injured by this; or, if it should, the adding of a new polish will not at all affect the colours. In the same manner the texture of stones, intended for any other experiments in staining, should be considered, and the choosing of proper ones may make this process succeed on them. Phil. Trans. No 1799.

STONE, Artificial. See Mortar and Stucco.
STONE, Bolognian. See Bologna and Phosphorus.
STONE, Butter of. See Butter of Stone.
STONE, Calamine. See Calamine.
STONE, Carph. See Carph.
STONE, Chib. See Cicerum Lapis.
STONE, Copperas. See Phosphoric.
STONE, Coral. See Coral.
STONE, Eagle. See Eater.
STONE, Eft. See Eft-Stone.
STONE, Emery. See Emery.
STONE, Fire. See Fire-Stone.
STONE, Flint. See Sarcites.
STONE, Fire, Grind, Gris, Gyphene, and Horbach. See Fire, &c.
STONE, Gall. See Biliary, and Biliary Calculus.
STONE, Horn. See Lapis Cornua.
STONE, Jos. See Judas Lapis.
STONE, Inert. See Inert Caustic.
STONE, Lime. See Lime.
STONE, Medical, a term used by some to express those particular stones, which for their real or imaginary virtues have, at one time or other, been made ingredients in medicinal preparations.

The opinions of the ancients, in regard to the virtues of gems and precious stones, were very whimsical. They supposed that they had certain sympathetic properties, and that the wearing of them on the finger, or carrying of them in the pocket, would cure diseases, render the gods propitious to their prayers, or save them from thunders. These have been deferentially laughed out of the world in our more enlightened times; but it has remained a question, and does so even to this time, whether or not some of the gems have not real medical virtues, naturally resulting from their parts, and constitutive matter. See Gem.

STONE, Meteoric, in Meteorology. Meteoric stones, or aerolites, are those stones which have been observed to fall from the atmosphere. (See Falling Stones.) In addition to the description of these stones, and the particular phenomena attending their fall, under that article, we shall state that numerous facts of a similar kind have since been noticed in various parts of the world; and the evidence of their actual descent from the atmosphere is full and satisfactory, though the mode of their formation still remains involved in much obscurity. The opinion that these stones are of atmospheric origin, and that the elements of which they are composed have been either held in solution in the air, or were formed there by the union of gaseous fluids, appears to us to agree better with the phenomena than any other which has yet been advanced. Though it may be difficult to explain the sudden formation of a solid mass of stone in the air, yet we have instances of a formation somewhat analogous occurring very frequently; thus, during violent thunder-storms, mazes of ice fall down in the hottest months of summer, sometimes weighing several ounces, and even pounds; and were the temperature of the earth constantly below 32° of Fahrenheit, they would remain as solid stones on the surface of the earth. The matter of which these masses of ice are formed, existed previously in a state of elastic aqueous vapour in the atmosphere; but by what process it was suddenly consolidated, during thunder-storms, is at present almost as inexplicable as the formation of meteoric stones. The nature of our atmosphere is but imperfectly known; for though we are acquainted with the proportions of oxygen and azote which it contains, we are not certain whether they are chemically combined, or only mechanically mixed; and with respect to the aqueous vapour, and other substains which are diffused through the different regions of the air, our knowledge is still more imperfect. Thus, though we know that, in the hottest months of summer, an immense quantity of water is rained into the atmosphere from the surface of the earth and seas, yet when this evaporation has continued for several weeks without rain, and consequently the atmosphere is charged with water, yet if it be examined by the hygrometer, it is not found as a liquid state. The importance of electricity, in all atmospheric phenomena, is universally admitted; but the mode of its operation is very little known. When these subjects are better understood, we have no doubt that the formation of meteoric stones will receive much elucidation. From the examination of rain-water, collected at a distance from towns, it is proved that lime and other substances exist in the atmosphere; and it is not improbable that the elements, of which meteoric stones are formed, may be sublimed from volcanoes, and diffused through the higher regions of the air, intermixed with hydrogen, or other inflammable gases (of greater levity) at present unknown. When these explode suddenly, large concretions may be formed; or, by slow combustion, they may form flowers of sulphur, or other substances, in a diffused or less compact state. In the Annales de Chimie, tom. ixxxv. p. 262, many curious instances of this kind are related, from which we select the following, as intimately connected with the descent of meteoric stones.

We ought probably to rank with meteoric stones the ignited bodies, or fire-balls, which are only distinguished from them by their substance not being metallic. Like meteoric stones, they generally fall in the warmest months, and in calm weather; they burn in the same manner, and traverse their path with the same velocity; their explosions are nearly similar, and that of 1772 had a rotation round its centre. These ignited globes have a roundish form and gelatinous consistence. A globe of fire which fell in the East Indies, in 1218, left, after a dreadful explosion, a round large heap of gelatine, of tolerable consistence. A similar mass, but grey and frouzy, was found at Coblenz, after the explosion of a ball of fire. Journal de Physique de Gilbert, tom. vi.

Silberschlag relates having seen the residue of an ignited globe, which presented a gelatious appearance, of a whitish colour.

The meteors called falling stars, do not appear to differ from globes of fire; they leave behind them gelatious mazes,
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maisses, falsely attributed to birds of prey, since they contain nothing which announces an animal origin. If igneous globes do not always leave similar residues, it is owing to their being composed of entirely combustible elements, and to their being consequentially dissipated before they reach the ground. We may refer to this kind of phenomenon, the globe of fire which, according to Geoffroy, burnt in the Palace du Quelen threat on the 4th of January, 1771, that which was observed in Anaphantine in 1803, and in Suffolk in 1802. With these globes of fire may be classed the flowers of fire, which can only be distinguished from them by their greater diffusion. In the fire-balls, the flame diffused substance is concentrated in one mass. A shower of fire made great ravages in Germany in the year 834, and burnt up whole villages. Another shower of the same kind fell, in 1571, in the grand duchy of Hesse: after a dreadful explosion it flowed through the streets, but without causing the destruction of the houses. A third shower of fire took place, in 1678, at Sachsen-Haufen, and the inflamed matter burnt half an hour in the streets before it was extinguished. Finally, that which fell over the city of Brunswick in 1721, was so violent, that they attempted in vain to extinguish it by means of water. The difference remarked between showers of fire, and those of an oily substance, which have frequently occurred, appears to consist in this—the substance of the former is in a state of phosphorescence, which is not the case with the latter. We may place after these singular flowers, those of a mucilaginous nature. As chemistry shows that mucilage approaches to the nature of honey and sugar, we might refer the honey-dews, as they are called, to the fame phenomena, for it is difficult to consider them as excretions of plants, as some have asserted. One of these flowers of dew took place at Ulm so recently as 1802, and in such abundance, that every thing exposed to it, as well as the surface of stagnant waters, was covered with it. It may, perhaps, be presumed, that the matter of which meteoric fônes and fire-balls are formed, is sometimes precipitated, in a very minute state of division, in flowers of sulphur or sand, and what have been falsely called flowers of blood.

The shower of brimstone which fell at Copenhagen in 1646, was accompanied with heavy rain, and the air was infected with the smell of sulphur. A shower of the same kind also took place at Copenhagen in 1665, after a very violent storm: the substance precipitated, emitted a strong smell of sulphur when thrown into the fire, and with spirit of turpentine it formed a kind of balsam of sulphur. In 1801, the rain which fell at Raftstadt was so sulphurous, that it was used to prepare matches. A red mineral shower fell in Westphalia in 1543, at Lowen in 1760, and at Embden in 1571: the latter was so extensive, that over the circumference of 10 or 12 leagues, all bodies exposed to it were dyed red. Similar showers fell in Ruffia, Swabia, near the lake of Constance, and at Lucarno, in Upper Italy; in the latter end of 1775. At Lucarno the atmosphere became quite red previously to the shower. The rain was almost as thick and heavy as snow, and the residue left by it was reddish, with an earthy appearance. In January 1810, a similar shower fell in the mountains of Placentia; its first appearance was white, but after some elapses of thunder it became red, and finally white again. In certain places it was of a flesh colour, but in others it was of a very deep red, and it always preferred its colour after having been melted. There are too many testimonies in favour of showers of sand having fallen, to allow us to deny the fact. One was observed at Bagdad in 930. (Quatre-mere Memoires fur P'Egypt.) Long before it fell, the sky was darkened by a red cloud, from which an immense quantity of reddish sand was precipitated, entirely different from the sands which exist in that country. A shower of ferruginous rain was observed in the Atlantic, lat. 45° and long. 53°, at a distance of five or six leagues from the main land: this shower was preceded by a strong light; it lasted upwards of nine hours, the air being calm during the time.

Showers of sulphur appear to admit of a more easy explanation than many of the above phenomena. Sulphuretted hydrogen gas is constantly emitted into the atmosphere from volcanoes and other sources; were this collected and exploded, or slowly burnt, a quantity of liquid sulphur would be precipitated.

The writer in the Annales de Chimie, before referred to, has attempted to generalize the circumstances attending meteoric fônes, but he appears to want sufficient data to establish some of his conclusions.

“First: The fall of these fônes,” he observes, “is most frequent in the months of June, July, and August. Of 65 or 70 of these recorded showers of fône, nearly two-thirds have occurred in the above months; and the influences of their occurrence in the winter months are very rare indeed.

“Secondly: From a catalogue drawn up with great care it appears, that only seven instances occur of fônes falling between midnight and noon. On one occasion only, this phenomenon was observed between 11 o'clock in the evening and 6 o'clock in the morning, whilst we have evidence of thirty-six having taken place between noon and midnight, and the greater part of these fell between 5 o'clock in the afternoon and sunset.” We may observe, that the defect of these fônes could not be so frequently noticed in the night as during the day, and therefore we do not think the author's conclusions on this head entitled to much notice.

“Thirdly: The number of these showers of fône decreases with the distance from the equator. These phenomena are more frequent in Italy, France, and Germany, than in the northern countries of Europe.

“Fourthly: We know,” says the author above referred to, “that no falls of sulphur having taken place in cloudy weather, or during a high wind, or a heavy continued rain or snow.”

The weather has been noticed during forty-three falls of fônes; twenty-nine fell in warm and serene weather, and two when the sky presented some scattered and inflatated clouds; the remaining twelve were accompanied by violent storms of rain and hail. Out of twenty-nine falls of fônes which took place in serene weather, twenty seemed to issue from a very extensive but round cloud, black or variable in colour, according to the colour of the fônes themselves. Thus, the cloud was white in the fall which took place at Burgos, and the fônes were also white. At all times the cloud seems essential to these meteors, for from it proceeds the noise which accompanies or precedes the fall of the fônes, as also the fônes themselves.

It may not be improper to remark, that the great fône which fell on the wold of Yorkshire, was unaccompanied with any meteor or light, and the sky was hazy. The progres of the great meteor in 1783, was unattended by any cloud; and though it exploded in various parts of its course, no desert of fônes was noticed. The cloud, which, from various authentic accounts, appears to be generally attendant on the fall of meteoric fônes, is supposed by some philosophers to contain these elements in a vaporous state. This cloud has sometimes been observed to have a rapid motion round its centre. During a very considerable fall of fônes in the department of the Lot and Garonne,
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Garonne, in France, Sept. 5th, 1814, a small white round cloud, but greyish in the centre, appeared to move with great rapidity over the district, where the flones fell: explosives, accompanied by lightning, immediately succeeded: the sky in other parts was serene; at the same instant, the cloud appeared to divide into three or four parts, and fall to the ground, leaving behind a train of rainbow-coloured light, with a red point at the top. The flones in their fall appeared to diverge, striking the ground obliquely in various directions. They do not differ in their composition from other meteoric flones. We have thus endeavoured to select some of the most interesting facts that have been recently noticed in this department of meteorology; and in the present state of information on the subject, it is of far greater importance to science to collect facts, than to advance the most elaborate speculations on the mode by which these singular bodies are formed.

It has been stated by Mr. Bakewell, in his Introduction to Geology, that what we already know with respect to the formation of flones in the atmosphere, may elucidate, in his opinion, the appearance of new flones, which have thone for a few years and then disappeared. The simplest form of matter with which we are acquainted, is that of gas or vapor.

"Let us for a moment consider the elements of which all terrestrial substances are composed as existing in this simple state, when the fiat of Almighty Power impressed upon the whole the various affinities by which they coalesced, and formed a fluid or solid mass. During their union, intense light and heat would probably be evolved, presenting to the distant inhabitants of the universe the appearance of a star of great brilliancy, but of short duration. The sudden concretion of flones makes in the atmosphere, with the intense light attendant their formation, may be analogous to the gaseous state of a planet." As we consider, however, that the phenomena of the appearance and disappearance of flones are satisfactorily explained upon other principles, we shall content ourselves with referring to the publication above cited, and to the article Star.

STONE, Moor. See Moor-Stone.
STONE, Philosopher's. See Philosopher's Stone.
STONEs, Portland, Purbeck, and Roll-rich. See Portland, &c.
STONE, Rocking or Logan, in Antiquity, a name given to a majestic mass, the weight of which, from moving on a small point, or pivot, was susceptible of being moved, or rocked to and fro, with very little force. These flones appear to have been objects of curiosity, wonder, and superstition, in remote ages, and in different countries. Many of them are still remaining in the mountainous parts of England, Wales, and Scotland, as well as on the European continent. Some of the ancient writers have noticed these flongan objects; and certain modern antiquaries have studied themselves, and tried with their readers, in alluing to them different supernatural properties. Pliny says, that at Harpasa, a town of the Lofa, there was a rock of such a wonderful nature, that if touched with the finger it would shake, but that it could not be removed from its place with the whole force of the body. Ptolemy Hephthion mentions a Gygonian flone near the ocean, which might be agitated by the talk of an alphabet, but could not be removed by the greatest human force. Dr. Stukeley considers the word Gygionus to be purely Celtic; and says, that Gwngog signifies Mottains, the rocking-flone. Although it is very evident that most of these rocking-flones are strictly natural in form and situation, yet it is generally supposed that others are artificial, or placed in their respective positions by human art. In the parish of St. Lewis, Cornwall, on the coast, on a promontory called Castle-Terry, are three groups of rocks, on the top of one of which was formerly a very large flone, so evenly poised, that by a very slight pressure it might be moved from one side to another. It was popularly called the Logan-flone, and has generally been visited as an object of curiosity; but it is now immovable. There are other rocking-flones, which are so peculiarly shaped and situated, that Dr. Borlase, and some other antiquaries, consider they were erected by human strength. Of this kind the doctor thinks the great Quoit, or Carnkew, in the parish of Tywideneck, Cornwall, to be. It is thirty-nine feet in circumference, and four feet thick at a tangent, and stands on a firm substratum. There is a remarkable flone of the same kind on the island of St. Agnes, in Scilly. The under rock is ten feet six inches high, forty-seven feet round the middle, and touches the ground with no more than half its base. The upper rock rests on one point only, and is so nicely balanced, that two or three men with a pole can move it. It is eight feet six inches high, and forty-seven feet in circumference. On the top there is a batin hollowed out, three feet eleven inches in diameter at a medium, but wider at the brim, and three feet deep. From the globular shape of one flone, the doctor thinks it highly probable that it was rounded by human art, and perhaps even placed on its pedestal by the strength of man. In Sithney parish, near Helston, in Cornwall, stood the famous Logan or rocking-flone, commonly called Mén-Amber, g. d. Men-an-Bar, or the top-flone. It was eleven feet in length, six feet wide, and four feet deep, and so nicely poised on another flone, that a little child (as Mr. Scawen in his MS. says) could instantly move it, and all travellers that came this way defied to behold it; but in the time of Cromwell, when all monumental rocks were desecrated, one Superflous. Then gre is a nor a Pendennis, by much ado, caufed it to be undermined, and thrown down, to the great grief of the country." Borlase says that it has marks of the tool on it. There is a rocking-flone in Perthsire, near Balvaird Castle, in the Ochil hills, Scotland, on the estate of Mr. Murray of Conland.

That these rocking-flones were employed by the Druids, to surplice and deceive the credulous, is very probable; but tradition has not informed us for what express purpose they were intended. Toland thinks the Druids made the people believe that they only could move them, and that by a miracle; by which pretended miracle they condemned or acquitted the accused, and often brought criminals to confess what could in no other way be extorted from them." Carew, in his "Survey of Cornwall," 4to, thus apostrophizes the Logan-flone:

"Be thou thy mother Nature's work,
Or proof of giant's might,
Worthless and rugged though thou flow,
Yet art thou worth the fight.
This hugey rock one finger's force
Apparently will move;
But to remove it, many strength
Shall all like feeble prove.

Borlase, in his "Antiquities, &c. of Cornwall," folio, 1769, has devoted a chapter to this subject, and gives also views of different rocking-flones.

STONE, Rotten. See Tripoli.
STONE, Sanguine. See Sanguine Stone.
STONE, Serpent. See Cornu Ammonite, and Ammonite.
STONEs, Stout. See Shald-Stone.
STONE, Toad. See Buponita and Toad-Stone.

STONE,
STONE. Touch. See TOUCH-STONE.
STONE, Wht. See Cos and WHAT-STONE.
STONEs, Characters on Toms. See CHARACTERS.
STONEs, Engraving on. See ENGRAVING.
STONE, Face of. See FACE.
STONE, Oil of. See OIL of STONE.
STONE, Sculpture in. See SCULPTURE.
STONEs, Staining of. See SOLUTIONs, &c. of STONES, and MARBLE.
STONE of Scandal. See SCANDAL.
STONEs, in Mythology, were objects of religious worship among the ancients, before the true church was invented. They were unburnt shapeless masses, called by the ancients ELEUSIS. (See BERTYLES.) Pausanias speaks of the statues of Hercules and the Cupid, which were merely such masses of stone. He adds, that there were seen, even in one place, 30 square stones, which had the names of 30 many divinities.

STONEs for Mills. Preparation of. The means of forming them for the purpose of grinding. In small corn-mills, where only one pair of stones is in use, they are, it is said, roughed on the surface, to enable them to tear, bruise, and reduce the grain, by the use of a small hand-pick. Stones thus prepared and refined were used for making corn-meal, which is best and most refined when rough, and large in the grain; but they are not capable of grinding barley or peas to that fineness of flour which is necessary for some uses. It is requisite to have a separate pair of stones for this purpose, which are dressed on the surface, with a small chisel, in grooves running in from the circumference to the centre, so as to form a wheel, in stone wool.

STONE-Dike, in Agriculture, that fort of dike or mound which is formed with stone and earth. Those dikes should, it is said, consist of a double face to two-thirds of their height, and the other third be of single stones, built up in an open form and manner, so as to hang firmly on each other. They are made in the Highland sheep districts, where this manner of forming them is much had recourse to, five or five and a half high from the surface of the ground. A dike thus built, when well executed, and filled with thorough-bred, thick, and defensible, it is said, to be a kind of animals, none of which are fond of venturing over it; whereas a green sod on the top of a double-faced wall invites the sheep to attempt clearing it, which they not unfrequently do with facility. These dikes are equally durable and cheap; even more so than the turf or sod covered or coped stone-walls, while they are greatly more effectual. They are the most proper for confining of sheep; and on farms purely of this kind, are perhaps the best fort of convenience for restraining them of any yet known. They have different names in different sheep districts.

The term is sometimes written stone-dyke.
STONE-Drain. See SPRING-Drain and SURFACE-Drain.
STONE-Picker. See PICKER.
STONE-Pickers, the name of such persons as are employed in picking stones from off the ground. In order to prevent the loss of time in filling and emptying the barrows, and that of having recourse to the team, the use of one horse and a light cart is advised, which attending seven or eight men, boys, and girls, may run over forty acres in about four days. It is advised by Mr. A. Young, that by farthing in a dry season, an opportunity should be taken to stone-pick the grass and clover fields intended for mowing. In this work, no stones are, he says, however, to be taken, but such as would impede the scythe. It is often the case, he adds, that the pickers, who generally like the work, will over-pick if they are not attended to, and propose to pick fields which are not to be mown; but this is on no account to be permitted, if the stones be not much wanted. It has been often remarked, and is a known fact, that too much stone-picking has done a very sensible mischief, in many cases where picked by authority of parliament for turnpike roads. And Mr. Macrae, of Suffolk, affirms it experimentally.

Observations have been made in other places, which clearly shew that the stones should not be wholly picked off many farms of land.
STONE-Roller. See ROLLER.
STONE Arabia, in Geography, a settlement in Montgomery county, New York, on the N. side of the river Mohawk, four miles from it, begun by some Germans; situated on an eminence about 54 miles W. of Albany. The soil is excellent, and the people industrious. It has two churches, a Calvinistic and a Dutch Reformed. Stone Arabia is a part of the polit-township called Palatine, (which see,) 51 miles from Albany, erected from the W. part in 1808. This polit-township is well watered and has many fine mill- sects, the land of which is under high cultivation. It was first settled by some German families in 1724. Palatine village has about 35 dwellings, some stone, &c. and a stone church; 55 miles from Albany. In 1810 the population of Palatine was 2111.
STONE Creek, a river of West Florida, which runs into the Mississippi, N. lat. 32° 8'. W. long. 91° 13'.
STONE Indians, Indians of North America, situated on the Aminiboine River. See ASHIBOINE.
STONE Island, a small island near the E. coast of Newfoundland, near Cape Breton, and one of the three islands which lie off Cape Breton.
STONE Mountain, a mountain that lies between the states of Tennessee and Virginia. N. lat. 36° 40'. E. long. 81° 40'.
STONE's River, a river of Tennessee, which runs into the Cumberland, fix miles N.E. of Nashville. N. lat. 36° 5'. W. long. 87° 49'.
STONE's Fort Gut, a creek on the S.W. side of the island of St. Christopher's, E. of Old Road bay, and between that and Sandy Point, with a fort on a point of land, on the W. side.
STONE Reef, a small island and rocks of Denmark, in the Little Belt, near the N. coast of the island of Allen.
STONE River, a river of North America, which runs into Lake Athapescow.
STONE, in Commerce, denotes a certain quantity or weight of some commodities.
A stone of beef, at London, is the quantity of eight pounds; in Herefordshire, twelve pounds; in the North, sixteen pounds.
A stone of glass is five pounds; of wax, eight pounds.
A stone of wool (according to the statute of 11 Hen. VII.) is to weigh fourteen pounds; yet in some places it is more, in others less; as in Gloucestershire, fifteen pounds; in Herefordshire, twelve pounds.
Among horse-couriers, a stone is the weight of fourteen pounds.
The stone troy, in Scotland, contains sixteen pounds, the pound being two marks, or sixteen ounces.
The stone, called flax in Germany, varies very much in different parts of the continent; at Amsterdam, a flem or stone is eight pounds; at Berlin, the centner or quintal weighs
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weights five drams or stones, each of twenty-two pounds: at
Hamburg and Prague, a stone of flux is twenty pounds, and
a stone of wool or feathers is ten pounds. See

WEIGHT.

STONE, in Medicine. See LITHOTOMY.

STONES of Animals, in Rural Economy, the organs of
generation in them, which, in all those that are intended
for this purpose, should be quite in a complete state of
production, and not in the rigid condition. See TESTICLES.

STONE-Fruit, in Botany and Vegetable Physiology. See

DRUPA.

STONE-Mummy, See RAUHY Mummy.

STONE-Pearly, in Botany, See BURON.

STONE-Pearly, Bajard. See SISON.

STONE-Phlegm. See LITHOPHORUS.

STONE-Plant. See LITHOPHYTON.

STONE-Sucker, in Ichthyology. See PETROMYZON.

STONE-Ware. See POTTERY.

STONE Blue, a preparation used in washing of linen. See

BLUE, INDIGO, and SMALT.

STONE-Braalh, in Agriculture, a term sometimes applied
to a looie flivory fort of soil or land. It has a surface of
greater or less depth, mollify of a looie, dry, friable fort of
fandy, lime-flowy, chalky, or loamy materials, which seem to
be formed from abraded matters of these flowy kinds, and
abounding with many fragments of them. In many dif-
tricks and places, these lands of this fort are chiefly of the lime-
floes and chalk kinds. It is a fort of land that prevails
much in some counties, as in Oxfordshire, Somerfethshire,
Bedfordsire, and probably in some others. It is sometimes
of a springy, spewy nature, refting upon deep beds of a blue
clayey, marly quality, under which is a vein of white marle,
extremely rich in calcareous matter, and below that rock of
the rough white lime-flowy kind. The blue and white
matters have occasionell been spread out over the surfaces
of these lands, and found very beneficial. These lands, in
some cafes, form excellent soills for the turnip husbandry, and
are very productive in wheat, especially where they are of the
more calcareous kinds.

They ansuer well for inclosing too in some inftances, in-
stead of being cultivated on the common field plan, as is still
too much the cafe in many places, notwithstanding the im-
provements which husbandry has lately undergone.

A variety of different covenants are suppofed necessary
for tenants in cultivating stone-braalh farms, as may be feen
in the Corrected Report of the Agriculture of the County of
Oxford. See SOIL.

STONE-Breach, the name of a perennial plant of the
weed-kind, common in pasture grounds. The root has a
sharpth and aromatic taste. The stalks are round, fkreaked,
and reddish towards the bottom. The leaves are smooth, of
a dark green, and divided twice, into long, narrow, sharpl
segments. The footstalks are membranous at the bafe. The
flowers grow in loose umbels, and are of a pale yellow
colour. The seeds are oval, skreaked and red at the top. It is
a plant of the faxifrage kind, which has been suppoled ben-
eficial in meadow lands, as improving the qualities of the
cheese and butter, which are made from the milk of the cows
which are pastured upon them.

STONE-Brether, in Ornithology, the name of a small
bird of the canathen, or fallow-finch kind, the motacilla rubi-
cola of Linnaus, called by some authors rubetra and muf-
sicapa, and in some cafes the fome-smich and the moor-sitting.
See Motacilla.

The head, neck, and throat are black, but on both sides
of the latter there is a white bar; the feathers on the back
are edged with towny; the lower part of the back, jiff

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above the rump, is white; the end and exterior side of the
two outermost feathers of the tail are of a pale rufus-colour,
the reins are black; the breast is of a deep reddish-yellow;
the belly of a lighter hue; the quill-feathers dusky, edged
with dull red; those next the body marked with a white
spot near their bottoms; and the coverts of the wings are
adorned with another. The head of the female is ferrug
ous, spotted with black, and the colours in general less
vivid: in both sexes the legs are black.

These birds are common, during summer, on heaths and
gorly grounds, but in winter disappear into marshes, &c. with-
out quittit the island: they make a very loud and often
repeated note. Pennant.

STONE-Crop, in Botany. See SEDUM.

STONE-Crop Tree. See Crenopodium.

STONE-Curlew, in Ornithology, the English name for the
cuculenuus, a bird of the colour of the curlew. See Stone-
Curlew.

STONE-Smich, a common English name for that spe-
cie of canathene, which we more frequently call the fome-
chatter.

STONEHAM, in Geography, a township of Middlesex
county, Massachufetts, incorporated in 1725, and containing
407 inhabitants; 10 miles N. of Bolton.

STONEHAVEN, a sea-port town in the parish of
Dunottar, and county of Kincardine, Scotland, is 107 miles
by sea from Edinburgh. It consists of two large streets of
houses, built on fens granted by the earls maritichal,
within whose estate, before their forfeiture, it was situated.
There is a fine harbour formed by a natural basin, defended
by a high rock upon the S.E., which extends into the sea,
and upon the N.E. by a quay, very convenient for the un-
lading of goods.

A manufacture for house-linen has been established here,
and the town has been improving for some years past.
The sheriff’s court for the county was removed from Kincardine
to Stonehaven in 1650, and in consequence of the gaol for
the county, and county courts held here, the town is much
benefited. The public revenue of Stonehaven consists
chiefly of shore dues, which amount to about 45L. annu-
ally. A great deal of lime is brought to this part; and
from four annual fairs, the revenues of the town are aug-
mented.

Stonehaven is a borough of barony, of which the jurisdic-
tion is by the charter vested in magistrates choften by the
superior and feuers. In 1793 the town contained 1072 in-
habitants, independent of the additional suburb. —Beauties
of Scotland, vol. iv. Carlile’s Topographical Dictionary
of Scotland, 2 vols. 40. 1813.

STONEHENGE, in Antiquity, an assemblage of up-
right and proffate stones on Salisbury plain, England, sup-
posed to be the remains of an ancient Druidical temple, which
claims particular notice in this work, as being often referred
to in foreign and English books, and from having been very
inaccurately described in most of those publications. Next
to the vast and far-famed pyramids of Egypt, Stonehenge,
and other remains of the same class, rank among the most
curious and most remote monuments of antiquity. These
are all anterior to written evidence, and are consequently
involved in the most abstrufe mystery. Hence they have
also occasioned much speculation; and many volumes and
essays have been written by English and continental anti-
quaries, with a view of explaining the origin and uses of
such structures. On the present occasion, it is intended to
describe clearly and explicitly what Stonehenge is, and
what it has been; to detail the opinions of different writers
on the subject, and thence endeavour to deduce a probable

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and rational inference refleeting this and other similar monuments.

Stonehenge, situated about two miles directly west of Avebury, and seven north of Salisbury, in Wiltshire, is an ancient and certainly very extraordinary monument of a remote age. From its singularity, and the mystery attending its origin and appropriation, it has excited more surprize and curiosity than any other relic of antiquity in Great Britain. When viewed at a distance it appears but a small and trifling object, its bulk and character are lost in the extensive space which surrounds it; and even on a near examination, it generally fails to satisfy or gratify the expectations of the stranger, who usually visits it with exaggerated prophecions. To behold this "wonder of the world," as it has been termed, with interest and satisfaction, it should be viewed with an ardent eye, and contemplated with a mindstoried with antiquarian and historical knowledge.

In various parts of the united kingdom, and also in foreign states, several circular erections of upright stones are to be found, some of which consist of a single, and others of complex circles; but Stonehenge is of a different and different character and clafs, and is, we believe, wholly unlike any other monument now remaining in Europe. Many of the stones in this temple have been squared or hewn by art; and on the top of the outer circle has been raised a continued series of squared stones, attached to the uprights by mortises and tenons, i.e. regular cavities in the horizontal stones, and projecting points on the perpendicular ones; whereas nearly all other examples, of what is generally called Druidical circles, are composed of rough, unhewn stones, and are without impostes.

By the plans, view, elevations, &c. in Plate Stonehenge, it is presumed the reader will be enabled to comprehend clearly and readily the original and present form, arrangement, and proportions of Stonehenge. A is the ground plan of the stones, as remaining in 1816: the darker parts shew those that are standing, and the light tints the fallen stones, or fragments; whilst the dotted lines indicate the impostes, or stones refting on the uprights. B is a view of the structure from the south-west, shewing part of the ditch and vallum; also two stones attached to the vallum, and remote from the body of the temple. C is a geometrical elevation on the north-west side, to shew the difference between the temple and the vallum c, the stone d within the ditch, and the stone a, still farther from the temple. Two stones, one now standing, a, and the other fallen, d, is presumed, formed part of a long avenue, similar to others at Avebury (see Avebury); b, a barrow; c, the vallum, rising on the outside of the sacred area. D is a ground plan of the temple, as supposed, by Dr. Smith, to be its original state. E is a section of the work on the line A B of plan D. The present appearance of this monument (see view B, taken from the south-west) is that of a confused heap of erect and fallen stones. The original arrangement of these (see plan D, vew E, and elevation C) may, however, be readily understood; for by the position and situation of the yet standing and prostrate members, we are enabled to judge of the number and ftate of those which have been removed. The whole consisted of two circular and two other curved rows, or arrangements of stones, the forms and positions of which are laid down in the plan, elevation, and fection, D, E, and F. (See Plate Stonehenge.) Horizontal stones, or impostes, were laid all round, in a continued order, on the outer circle; and five similar impostes on ten uprights of the third row. According to the plan referred to, Dr. Smith represents two other smaller trilithons, as forming part of the third row. The whole is surrounded by a ditch and vallum of earth, connected with which are three other rows. The vallum does not exceed fifteen feet in height, and is exterior to the ditch. Through this line of circumvallation there appears to have been an grand entrance from the north-east side, and this is decidedly marked by two banks and ditches, called the Avenue. Approaching Stonehenge in this direction, the attention is first attracted by an immense uncultifed stone, called "The Friar's Heel," which is now in a leaning position, and measures about sixteen feet in height, c. a. Immediately within the vallum is another stone, lying on the ground, three sides of which bear the fame marks of tools as the large uprights, and was evidently once standing. In length it measures twenty-one feet two inches, of which three feet six inches appear to have been formerly under ground when it fould upright. Its distance from the fence last-mentioned is one hundred feet; and it is nearly the fame distance from the outside of the outermost circle of the monument. Each impost of this row has two mortises in it, to correspond with two tenons on the top of each vertical stone. The impostes were connected together in such a manner, as to form a continued series of architraves. The uprights in this circle differ from each other in their forms and sizes; but their general height is about fourteen feet, and the measure of their sides seven feet by three. The space between them also varies a little; that between the entrance-ffones (see Plan D, a) is five feet, being somewhat wider than in the others. The diameter of this circle is one hundred feet, and the number of upright stones it originally contained, thirty; of which seventeen are still standing, but there are no more than five impostes. (Plan A, g.) At the distance of eight feet three inches from this outer circle, is an interior row, which, Dr. Stukeley remarks, consisted in its original state of forty upright stones. Wood, in his account of Stonehenge, states their amount at twenty-nine only, and affirms that they were formerly covered with impostes; but Smith, in his "Choix Gaur," specifies thirty. The stones of this circle are much smaller, and more irregular in their shapes, than those of the outermost row, and also differ from them in species. The number standing is only eight, but there are the remains of twelve others lying on the ground. A few particulars reflecting this circle claim attention. Dr. Stukeley, in his ground plan of Stonehenge, has placed the two stones at the entrance, (Plan D, b, 6,) a little within the range of the others, and observes, "that the two stones of the principal entrance of this circle, correspondent to those of the outer circle, are broader and taller, and set at a greater distance from each other, being rather more than that of the principal entrance into the outer circle. It is evident, too, that they are set somewhat more inward than the rest: so as their outward face stands in the line that marks the inner circumference of the inner circle." A stone lying near the above, and apparently belonging to this circle, resembles the impost of a small trilithon, and most probably gave rise to the inference of Wood, that all the stones of the smaller circles had impostes. See Plan A, g.

Within the circles just described are arranged two inner rows of stones, one of which constitutes the grandest portion of Stonehenge. It was formed by five distinct trilithons, or two large upright stones, with a third laid over them as an impost. Dr. Smith conjectured that this arrangement consisted of seven pairs of uprights, with an impost to each pair; whilst Dr. Stukeley gave them the name of trilithons, or three stones. The largest trilithon was placed in the centre, opposite the entrance, and measured, when
STONEHENGE.

when standing, exclusive of the impost, twenty-one feet six inches in height (Plan D, d); those next to it, on each side, were about seventeen feet two inches (D, e, f) ; but the others were not more than sixteen feet three inches (D, s, f). Thus we perceive a progressive rile in the height of these trilithons. Besides, the stones are evidently more regular in their shapes, and more carefully formed, than those in the outer circle. At present, we find that only two of these trilithons are perfect (Plan A, z, and g). One of the uprights is standing at z; but leans inwards, and rests on 10. The next trilithon, s, fell down in the year 1787, and it is remarkable, that this is the only alteration recorded of Stonehenge. At s, one of the uprights is standing; but its corresponding stone and the impost have fallen, and are broken into several pieces.

The interior row of stones which next claims attention, consists, according to Stukeley, of nineteen uprights, without impost; but their original number is differently stated by other authors. These stones "incline to a pyramidal form." The most perfect among them, according to the measurement of Sir Richard Hoare, is seven feet and a half high, twenty-three inches wide at the base, and decreases to twelve inches at the top. Another is remarkable as having a regular groove from top to bottom, and as being "bevelled almost to an angle on the inner side." For what purpose the groove has been formed, it is impossible to conjecture; and it is equally difficult to say whether the hollow has been formed by nature or art. (D, z; and A, 10.)

The altar-stone, as it is usually called, lies flat on the ground, and occupies the cove, or adytum of the temple. Two other stones belonging to this monument remain to be noticed: they are situated close to and within the vault, one on the south-east side, and the other on the north-west side; the former measures nine feet in height, and has fallen from its base backwards on the vault; but the latter is not more than four feet high; and both are rude and unhewn. Two small hollows likewise appear adjoining the bank, which merit particular attention in a description of Stonehenge. Dr. Stukeley considers them to have been the sites of two altar stones, and the cavities round them are conjectured to have received the blood of victims. The fallacy of the doctor's opinions, however, on this subject, is sufficiently proved by the investigations of Sir Richard Hoare, who, upon digging into them, found one to contain a simple interment of bone.

The total number of stones of which Stonehenge was composed, according to Dr. Smith's plan and calculation, in its complete state, was one hundred and twenty-nine. Thus, the outer circle contained thirty, with thirty impost; the second, or inner circle, thirty; the third interior row, fourteen, and seven impost; and the fourth interior row thirteen; the remainder are the altar-stones, the three stones adjoining the agger, and the large stone in the avenue.

Natural Quality of the Stones.—Those of the outer circle, and third row, with the stone in the avenue, and those adjoining the vault, are, according to Dr. Townshend, in Tracts and Observations on Natural History, &c. all "of a pure, fine-grained, compact sand-stone, and only differ a little in their colour; some of them being white, and others inclining to yellow." These stones resemble precisely in their quality the grey-weathers, and numerous other detached masses which lie on the surface of the Downs, in the vicinity of Avebury and Marlborough. The second circle, and the interior row, consist of a "fine-grained grünstein," interpersed with black hornblende, felspar, quartz, and chlorite, excepting four in the circle; one of which is a fiddleous schist, another an argillaceous schist, and the others horn-fine, with small specks of felspar and pyrites. The slab, or altar-stone, is different from all these, being a kind of "grey cos, a very fine-grained calcareous sand-stone," which strikes fire with steel, and contains some minute fragments of silver mica. Many persons have absurdly supposed that these stones are artificial, and formed in moulds.

The mystery of Stonehenge, the legendary stories connected with it, and the natural and artificial features of the surrounding plain, are certainly calculated to make strong impressions on the mind of every spectator. The area of the temple, as may be readily supposed, has excited the attention of the curious in a high degree, and, consequently, has been examined with considerable care by different antiquaries. Stukeley, indeed, informs us, that a tablet of sin was found there in the reign of Henry VIII., and would wish it to be believed that it was a memorial of the founders, because the character engraved upon it were unintelligible to the most learned antiquaries of the age. It is much to be regretted that this relic is lost. Mr. Cunliff investigated this spot and the adjoining barrows with great care, but could only find a few fragments of Roman and British pottery, with some charred wood and animal bones; such as were dug up in the vicinity of the Roman British habitations on other parts of the plain.

Avenue and Curfus.—But though the area of this monument affords few materials of interest, the surrounding plain deserves particular attention. This is covered with a profusion of barrows, unparalleled in any spot of similar extent in England, and probably in the world. Many of these were opened by Sir Richard Hoare and his indefatigable coadjutor, Mr. Cunliff, and were found to contain, in some instances, cists filled with burnt bones, and in others entire skeletons, with various relics of British art. Some other objects here, however, beside the barrows, present themselves to our notice. The principal of these are the Avenue and the Curfus, the former of which has been previously noticed. It is a narrow strip of raised ground, bounded on each side by a flight bank of earth, and extending in a straight line from the entrance through the vault of Stonehenge on the north-east to the distance of five hundred and ninety-four yards, at which spot it divides into two branches, one of which continues southward, and is seen between two rows of barrows, while the other proceeds northward, and approaches within a few yards of the curfus. The left is a very curious and interesting appendage to Stonehenge, if such it can be properly considered, and certainly ranks among the most perfect vestiges of this fort that are to be found in our country. It is a flat tract of land, bounded by two parallel banks and ditches, and is situated about half a mile N.E. of the temple; it measures one mile five furlongs and one hundred and seventy-six yards in length, and one hundred and ten yards in breadth. Its direction is from east to west, and at the former extremity is a mound of earth, reminding a long barrow, which stretches entirely across it. The western extremity is deflected of any mound like that at the eastern end; but there are two barrows, irregularly placed within the area of the curfus, a part of which appears also to be cut off by a flight bank. The original purpose of this it is difficult to determine, for we can scarcely suppose that if (as would seem most probable from the existence of the mound) the chariots started from the east end, they would drive over this bank to the termination of the course at the west end. We should therefore be inclined to think it had been raised at a later period for some object different from racing, did we not perceive that another similar bank is thrown across a second and smaller curfus, which is situated at the distance of nearly a mile from the
larger one. From the near resemblance of the above work to the curiaus of the Romans, it seems reasonable to suppose, that if the earth-works were not formed by that people, they were made in imitation of them, and by a class of people familiar with their manners and customs. Having thus given a full, and, it is hoped, clear account of what Stonehenge has been and is, it will be necessary to review the writings of those antiquaries who have published their opinions on the subject. See HIPPENSTIN.

Writers on Stonehenge.—The earliest account of Stonehenge occurs in the writings of Nennius, who lived in the eighth century. He narrates the story of the massacre of four hundred and sixty Britons, at a conference between King Vortigern and Hengist, at or near the spot on which our monument is situated, and attributes its erection to the Britons, who thereby endeavored to perpetuate the memory of this tragic event. The historical Triads of the Welsh also refer its origin to the same cause, and relate that it was constructed by Merlin, at the desire of Aurelius Ambrosius, the successor of Vortigern, after he had punished the perfidy of Hengest. This likewise is the account of Walter de Mapes, a Welsh chronicler, who is very circumstantial in his narrative.

Jeffery of Monmouth is another monkish historian, who gives, with some flight variation, a similar account of the origin of Stonehenge. The same story is also noticed by some other authors about the same era, and particularly by Giraldus Cambrensis, who farther relates that, during his tour through Ireland, he "saw with his own eyes" an immense monument of stones on the plains of Kildare, or Killarana, corresponding in appearance and construction with that of Stonehenge. Henry of Huntingdon calls this structure one of the wonders of Britain; but disbelieving the story of Merlin, candidly confesses that no one can devise by what means, or for what purpose, such a work could have been erected. Camden, the great antiquary and chorographer, characterizes this monument as an "infana subfructio," or a wild structure. His description of it is so very erroneous and defective, that we doubt much if he ever saw the place. On the question of its origin and uses he forbears to give any opinion.

Such is the scanty information which certain old writers, commonly called historians, furnish relative to this curious monument of ancient times. Modern authors on the subject have thrown aside every item of historical information, and have raised their theories concerning it solely on speculative foundations. Of these theories, that of Inigo Jones first demands attention. His essay was undertaken at the desire of King James I., who commanded the "author to produce of his own practice in architecture, and experience in antiquities abroad, what possibly he could discover concerning this of Stonehenge." Jones did not, however, live to complete the proposed work; but his son-in-law, John Webb, finished and laid it before the public in one small folio volume, with a portrait of the author, and several plates, A.D. 1655. In this work he endeavours to shew that Stonehenge was a temple of the Romans, dedicated to Calus: but unfortunately for Jones's theory, he has committed palpable errors in the form and arrangement of the stones, and has thus rendered his descriptions and assertions untenable and untrue.

Jones's work was succeeded, in 1665, by an answer and dissertation from the pen of Dr. Charleton, who contends that Stonehenge was an erection of the Danes; but, unfortunately for his theory, the monument existed long previous to the settlement of any Danes in Britain. Nennius, who first notices it, wrote anterior to the year 800, at which period people had not entered Wiltsshire.

Dr. Charleton's dissertation introduced a voluminous essay in support of Jones, by his editor, Mr. Webb, in folio, 1665. This volume abounds with dulness, sophistry, misstatement, and proximity. It was followed by a volume from Aylett Sammes, who, after recapitulating the former suppositions respecting Stonehenge, remarks, "why may not these giants (alluding to the title of Choreas gigantum given to our monument) be the Phoenicians; and the art of erecting these stones, instead of the stones themselves, brought from the farthermost parts of Africa, the known habitations of the Phoenicians." This idea, however plausible it may seem, completely fails, from the want of evidence to prove the settlement of those people in England.

Bishop Gibson, in his edition of Camden's Britannia, 1694, after opposing the suppositions of Jones and Charleton, concludes with observing, that "one need make no scruple to affirm, that it (Stonehenge) is a British monument, since it does not appear that any other nation had so much footing in this kingdom, as to be authors of such a rude and yet magnificent pile." The learned prelate is followed in the same spirit by many succeeding writers, though they differ from each other in the period of its origin, and the purposes of its erection.

Dr. Stukeley, more fanciful than correct in his reasoning, published a folio volume in 1740 on the subject, containing several plates. In this volume he attributes the work to the Druids; but, instead of refting his theory upon solid Britten ground, he takes up a large portion of his essay with irrelevant dissertation and speculation. Wool, an architect of Bath, devoted much time to make plans of this structure, which he published with an essay, in 1745. His opinion is, that it was a temple, erected by the British Druids about a hundred years before the Christian era.

William Cooke, M.A. in a treatise entitled "An Enquiry into the Patriarchal and Druidical Religion, Temples, etc.," 1775, supposes Stonehenge to have been a place held face by the Druids, and appropriated to a meeting of great assemblies on civil or religious occasions; and adds, "the world does not afford a nobler spot. Its situation is upon a hill, in the midst of an extended plain in the southern part of the kingdom, covered with numerous herds and swarms of sheep, in which respect the employment and the plain itself are patriarchal; where the air is perfectly salubrious, and the yielding turf fine as the surface of a bowling-green."

Dr. Smith, whose work on Stonehenge, called "Choir Gaur," appeared in 1770, after giving an account of the theories of Jones and others, with copious extracts, and a minute decription of the monument itself, says that he considers it to have been of Druidical origin, and erected as well for the purpes of astronomie observation as of religious ceremonials.

King, in his "Monimenta Antiqua," conjectures that this monument was constructed in the very latest ages of Druidism, while that religion was struggling against the overwhelming tide of Christianitie. This gentleman, however, had such strong prejudices and antipathies against every thing pagan, that he could never mention this, or any other anti-christian temple, but in terms of reprobaation.

Mr. Davies, the learned author of "Celtic Researches," and of the "Mythology, &c. of the British Druids," enters more profoundly, perhaps, than any other author into the question in the latter work respecting the origin and appropriation of Stonehenge. He supposes that this structure, and Silbury-hill, (which has already been described under the articles Avebury and Barrow,) are two of the three works alluded
STONEHENGE.

Alluded to in a Welsh Triad, as constituting the greatest labours of the island of Britain, i.e. "lifting the stone of Ketti;" "building the work of Emrys;" and "piling the mound of the allembles." That Stonehenge is really a Druidical structure, the fame learned writer farther remarks, "is evident from the language in which it was described, and the great veneration in which it was held by the primitive bardics, those immediate descendants and avowed disciples of the British Druids. As the great sanctuary of the dominion, or temple of our heathen deities, so complex in its plan, and constructed upon such a multitude of astronomical calculations, we find it not exclusively dedicated to the Sun, the Moon, Saturn, or any other individual object of superstition; but it was a kind of Pantheon, in which all the Arkite and Sabian divinities of British theology were supposed to have been present; for we perceive Noe and Hu, the deified patriarch; Elyon and Rheiddin, the Sun; Elyoe, Ifis; Kad, Ceres, with the cell of her sacred fire; Llywyy, Proferpine; Gwydien, Hermes, Bud, Victory; and several others." As to the precise date of Stonehenge, Mr. D. remarks, that the Druids could account for such the Druids could account for many of the stones at Stonehenge, and remarks, that it was most likely of later origin than the introduction of the Helio-Arkite superstition, which is traditionally said to have been of foreign origin, and to have come into England by the way of Cornwall, and, therefore, probably from the tin-merchants. He also remarks, that "it was a monument of venerable antiquity in the days of Hengist; and that its peculiar sanctity influenced the election of the spot for the place of conference between the British and Saxon princes." P. 985, &c.

Mr. D. farther mentions a passage in the Greek historian Diodorus Siculus, describing a round temple dedicated to Apollo, which Mr. D. concludes to have been most likely our monument of Stonehenge. The substance of the Greekian author is: "Among the writers of antiquity, Hecateus and some others relate, that there is an island in the ocean, opposite to Celtic Gaul, and not inferior in size to Sicily, lying towards the north, and inhabited by Hyperborees, who are said because they live more remote from the north wind. The soil is excellent and fertile, and the harvest is made twice in the same year. Tradition says that Latona was born here, and hence Apollo is worshipped above any other deity; to him is also dedicated a remarkable temple of a round form, &c."

The Rev. James Ingram, in his "Inaugural Lecture on the Utility of the Saxon Literature," has suggested a new idea relative to Stonehenge: he considers it to have been defined as an heathen burial-place, and the curfew adjoining as the hippodrome upon which the gods of the deceased were run for at the time of the burial." This opinion is entitled to some credit and consideration, from the vast number of barrows which abound in this part of the plain.

The late Mr. Cunningham, in the "History of Ancient Wiltshire," folio, 1812, grounds a novel supposition on the difference in quality and size between the stones of the great circle and interior row, and those of the smaller ones: and thence he supposes, that Stonehenge was erected at different periods. He also supposes, that the larger stones, with their imposts, constituted the old, or original work; and that the smaller stones of the second circle, and those of the inner range, were raised at a later period, as they add nothing to the grandeur of the temple." To exemplify this opinion, Mr. D. remarks, that Richard Hoare has given a bird's-eye view of the structure, thus divested of the smaller stones. Unfortunately for the theorist, this system is not warranted by any example among the numerous Druidical circles of Great Britain; but, on the contrary, it will be more consistent with these, and with the practices of remote ages, to conclude, that the second circle of small, rough, unhewn stones, with another circle immediately within the ditch, and some other members, now destroyed, formed the original, primitive temple. Many arguments might be used to exemplify this opinion; and also to prove that the great circle of upright chiselled stones, with their imposts, and the third row of trilithons, were posterior to the former, raised by other clays of people, and executed at a time when their principles and arts had been considerably changed. Contemporary with which it is conjectured, that an avenue of stones was raised, extending from the temple towards the curfew to the north-east; and also that those places for races and for other sports were formed at a time when the inhabitants of Britain had intercourse with the Greeks, or Romans.

A learned and eloquent writer in the "Edinburgh Review," for April 1806, in noticing Barry's account of the "Orkney Islands," remarks, that "rone circles, besides being used as places of worship, and courts of justice, evidently served the purpose of rude astronomical observatories, since the sun appeared to stand still in them, at the times which were considered as the most sacred of the fun, moon, and stars; the feasts of the year; and even the hours of the day; and where they are tolerably entire, a flight degree of attention would enable any person to do so at this hour. The sun seems to have been a great object of veneration, as an emblem of the deity."

With the following extract from Sir Richard Hoare's "Ancient Wiltshire," we shall conclude our account of Stonehenge.

"It may be naturally expected, that, after quoting the various descriptions of others respecting Stonehenge, I should give some opinions of my own. This I shall do with diffidence, and lament that the history of this celebrated 'wonder of the world' will most probably ever remain unknown. I cannot for a moment hesitate in declaring it to be neither Roman, Saxon, nor Danish. We learn from the Holy Scriptures, that the earliest memorials were of stone; and we find to this day, single, double, and triple upright stones, as well as numerous circles disfigured about our dominions: we then find stone attempts at architecture in the cromlechs and kiltvans, both of which we see immense pieces of the fun, moon and stars; the feasts of the year; and even the hours of the day: and where they are tolerably entire, a flight degree of attention would enable any person to do so at this hour. The sun seems to have been a great object of veneration, as an emblem of the deity."

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"The most remarkable of these monuments, and such as must excite curiosity in the highest degree, is situated in the hamlet of Carnac, near Vannes and Auray, on the western coast of Bretagne, and in the department of Morbihan, in France. M. Cambray, in his 'Monumens Celtiques,' has given a very detailed and animated description of this interesting relic of antiquity. He tells us, that some detached stones on the hills and sand-banks announce the approach to this grand theatre, which consists of an immense number of rude tumuli or small barrows, standing in an upright position, on a sandy plain, near the sea-coast. They are ranged in eleven straight lines, which lines are separated from each other by a space of thirty or thirty-three feet, and the distance from one stone to another varies from twelve to fifteen feet. The height of these stones measures twenty-
twenty-two feet out of ground; the width varies; one of them is twenty-two feet high, twelve feet wide, and six feet thick; and many of them are movable; these stones present the most singular aspect; they stand alone on an extensive plain, attended only by the land that supports them, and the vault of heaven that surrounds them; not an inscription to explain, nor an analogy to inform; the men whom you call, the traveller whom you interrogate, gaze at it, and either turn away their head, or recount follies. They recall to our memory those times which neither our calculation nor our history can ever attain.

"I have before stated my opinion, that our earliest inhabitants were Celts, who naturally introduced with them their own buildings, customs, rites, and religious ceremonies; and to them I attribute the erection of Stonehenge, and the greater part of the sepulchral memorials that still continue to render its environs so truly interesting to the antiquary and historian."

"The general title of Druidical has been given to all these stone monuments, and some of my readers may be surprised that I have not adopted it. That the Druids existed in our island at a very early period, and officiated as priests, there can be no doubt; but, as the learned Mr. Bryant, in his Mythology, observes, 'under the fashions of their names, we shelter ourselves whenever we are ignorant and bewildered.' And Mr. Borlase, with equal justice, remarks, 'that the work of Stonehenge must have been of that a great and powerful nation, not of a limited community of priests; the grandeur of the design, the dintance of the materials, the tedium of the work, which all such massive works are necessarily attended, all shewed that such designs were the fruits of peace and religion.'"

Besides the works already referred to, the preceding account has been chiefly derived from the Topographical History, &c. of Wilts, in vol. xiv. of "The Beauties of England," by J. Britton, F.S.A. 1814. "The History of Ancient Wilts," folio, by Sir Richard Hoare, with numerous plates of Stonehenge, the barrows on Salisbury plain, and the discoveries made in opening them, is most curious and interesting; and truly honourable to the liberality and perseverance of the worthy baronet, who has so laudably employed his time. One of the plates in this volume is more peculiarly interesting, as displaying a plan of the chalice of the temple, the avenue, the situation, and extent of the great curvus; also a smaller curvus, with numerous ditches, barrows, and encampments, in the vicinity of Stonehenge. Comte Alexandre de la Borde, in an elegant work now publishing in Paris, entitled "Les Monuments de la France classé chronologiquement," &c. has given views and accounts of some curious Celtic monuments in that kingdom.

STONEHOUSE. See Plymouth Dock.

STONESHATTER LAND, in Agriculture, a term applied to that fort of land which is constituted of loose, reduced, mixed, stony materials, and which is of a light, dry quality, capable of being wrought at almost any time. It is often good turnip land with but little cultivation and nurture. See Soil.

STONI, in Ancient Geography, a people of the Alps, according to Strabo, who join to the Lepontii and Tridentini. According to Livy, they were subjugated by the confid Q. Marcus.

STONINGTON, in Geography, a port-town and port of America, in New London county, Connecticut, 14 miles E. by S. from New London city, separated from Rhode island by the E. line of the state, settled in 1658, and containing a church, a court, and a place of worship, and 3043 inhabitants, of whom nine are slaves.

STONEHUTT, North, a town of Connecticut, in New London county, containing 2524 inhabitants, of whom two are slaves.

STONE INLET, a channel on the coast of Carolina, S. of the channel of Charleston, at the N.E. corner of John's island, which is bounded by Stono river on the west. N. lat. 38° 41'. E. long. 80° 2'.

STONY CREEK, a small stream of Upper Canada, which runs into lake Erie, E. of Sagona creek, having a harbour for boats.

STONY HILL, situated in Baltimore county, Maryland, 5 or 6 miles N.W. of Whetstone Fort, at the mouth of Baltimore harbour, and two miles S.E. of Hook's Town.

STONY ISLAND, an island near the E. coast of Labrador. N. lat. 53° 4'. W. long. 55° 30'. - Alto, a small island in the Spanish Main. N. lat. 14° 20'. W. long. 82° 45'.

STONY MOUNTAINS, mountains in the N.W. part of North America, extending from S. to N. in a N.W. direction, from N. lat. 48° to 68°. The north part of this range is called the Mountains of Bright Stones.

STONY POINT, a small village in Orange county, New York, projecting from the W. bank of Hudson's river into Haverferray bay, about 40 miles N. of New York city. The population of Haverferray in 1810 was 1816, including 36 slaves.

STONY RIVER, a river of West Florida, which runs into the gulf of Mexico. N. lat. 29° 55'. W. long. 84° 13'. See also Roche.

STONY STRATFORD. See STRATFORD.

STONY LANDS, in Agriculture, such as are full of flints, pebbles, or small fragments of free-Rome. It is found that lands of this sort, in many places, yield good crops; and the general rule is, that in flint and cold lands, the stones should be as carefully picked out as possible, but in light and dry grounds they should be left. These lands should, however, have the large stones removed as soon as possible. See Clearing of Land.

In some parts of Suffolk, the flinty stones, in cafes where they have not been picked off the land, lie so thick as effectually to cover the ground; and it is said to be a curious and interesting to see how the vegetation flourishes and gets through such beds of flints. The common opinion there is, that if the farmers were to put themselves to the trouble and expense of picking them off the land, the soil would be made materially injured; and that some, indeed, who have tried this experiment, are thoroughly convinced of the loss thereby sustained, the land having never since produced such fine crops of corn as before; this, however, only applies, it is thought, to places where the stones are very numerous and closely belet upon the land. See Stone, in Agriculture.

STONYHARD, the name of a plant of the weed kind, common in arable lands, the corn gromwell.

STOOK, or Stook, the common name of a short or hat-toc of corn or grain set up in the field. See HATTOCK.

In some districts, a distinction is made in this mode of putting up corn in the field, the floka or flouk consisting of twelve sheaves, while the hattock has only ten.

STOOKING, or STOOKING, the operation of setting up the sheaves of grain into floka, flouks, or hattocks, in the field, to guard them from rain. It is sometimes written FOXING. It was formerly the practice to set one sheaf upper-right, with the ears uppermost; and round that to place a circle of many other sheaves, in the same direction, inclining on the first sheaf; then to lay an horizontal circle of sheaves, with all the ears in the centre, and cover those ears with a loaf.
STO

Boofe sheave or two. And thus placed, they are paid to be well protected from all wet. But a better mode is that which is practiced in Yorkshire, as described by the Rev. Mr. Comber; ten sheaves are disposed in two rows, each row leaning against the other; then two sheaves are opened at the ear-ends, and slipped on the top, so as to meet at the centre with their tails, and to slope downwards. In this mode the air has a free course, whether it bears against one or other end of the floof, or even against either side of it. Thus, two weighty sheaves afford a good cover, and continue to be blown away by any wind, if carefully laid on: at least not to be blown away but so as soon to be replaced. And the flooping position of the cap-sheaves neither exposes them to receive directly, nor to retain or transmit the rain to the corn below, but to throw it off, especially as the tails of the sheaves, in which the flour is thickest and strongest, receive the most rain, which can do them little or no harm, and especially if they be thrust closely together. See Harvesting and HATTOCK.

STOOL, Alvis, in Medicine. A thing is said to be voided by floof, when it is discharged by the anus, or fundament. In the Philosophical Transactions, we have instances of sick persons voiding facetious Roes, balls, &c. by floof. See Alvis and DEFECATION.

STOOLS, Bloody, in Medicine. The spirit of vitriol, mixed with the patient's drink, has often been found beneficial in cases of bloody floos. See Dysentery and FLUX.

STOOLS, Retention of the feces in infants. See INFANT.

STOOL, in Mining, is used when the miners leave digging deeper, and work in the ends forward. The end before them is called the flool.

STOOLS, in Ship-Building, pieces of plank bolted to the quarters, for the purpose of forming and erecting the quarter-galleries, and sometimes to the ship's sides abait the masts for the backslats. Also ornamented blocks of wood for the poops and top-lanthorns to stand on.

STOOL, Cucking. See CUCKING.

STOOL, in Agriculture, a term used provincially to signify, to ramify or tiller, as grain.

STOOLS, in Gardening, such headed-down young trees and shrubs in the nursery-ground, or other places as are appropriated for the production of an annual supply of lower shoots or branches near the ground, properly situated for layering. See LAYERING.

STOOLS, Hop, in Rural Economy, the small contrivances of this kind which are made use of in hop-gardens, in picking the produce from off the bines, in some districts. They are thought useless and improper in some hop plantations in different districts, and of course never employed; but in others they are still continued, and supposes to be of considerable utility and benefit in the execution of the above sort of work.

STOMING of Wine, a term used to signify the putting of bags of herbs or other ingredients into it to prevent fermentation.

STOOP, in Commerce, a liquid measure in Holland and Flanders. See Tab. XXXII. under MEASURES.

STOOP, in Rural Economy, a post fixed in the earth, as a gate-post, &c. and many other forts.

STOOPEN, in Falconry, is when a hawk, being upon her wings at the height of her pitch, bends down violently to take the fowl.

STOOR, in Rural Economy, a term signifying to rise up in clouds, as smoke, dust, fallen lime, and some other matters.

STOREN, in Geography, a town of Norway, in the province of Dronthem; 36 miles S.W. of Dronthen.

STOOTER, in Coinage, a small Dutch silver coin, valued at 34 flivers.

STOP, in the Manege, is a paufe, or discontinuation of going. In order to stop a horfe, the rider should, in the first place, quicken him a little, and at the instant when he begins to go faster than the usual cadence, or time of his pace, bring to the calves of his legs, to animate the horfe, and to make him bend and play his haunches; then flinging his shoulders backwards, hold the bridle more and more tight, till the floop is made; then vigorously extend the hams, and rest upon the flirrups, to make him form the times or motions of his floop, in fagcading with his haunches three or four times. You should not form the floops of your horfe short and precipitate, left you spoil his hams and mouth. After flooping, a horfe should be made to make two or three corvettes.

With a raw and young horfe very few floops should be made; and when they are made, they should be performed by degrees, very gently, and not all at once; because nothing so much strains and weakens the hocks of a stifl and awkward horfe as a fudden and rude floop. It is an universally agreed point, that nothing shews so much the vigour and obedience of a horfe, as his making a beautiful and firm flop at the end of a swift and violent career. The facility of stopping, however, depends upon the natural aptness and content of the horfe, and also upon his form and the proportions which the different parts of his body bear to each other. The merit of a flop muft, therefore, be estimated by the strength and temper of the horfe, by the flexibilities of his head and neck, and the condition of his mouth and haunches. If your horfe has not readily obeyed in making his flop, make him go backwards, by way of punishing his fault. If in flooping he tolles up his nofe, or forces the hand, keep your bridle-hand low and firm, and your reins quite equal; give him no liberty, prefs upon his neck with your right hand, till he has brought down his nofe, and then immediately give him all his bridle; this is the surest method to bring him into the hand. To compel a horfe to flop upon his haunches, nothing is so efficacious as a little flooping ground; nevertheless you must examine, previously to this kind of exercise, if his feet, reins, shoulders, and legs, are able to bear it; for otherwise your horfe would soon be spoiled. In this case the rider shou'd put the stirrups of his aids rather in his thighs and knees than in the flirrups. One of the most trying lessions to which a horfe can be put is to flop him, and make him go backwards up hill; and therefore, on these occasions, you must ease the fore-parts of the horfe as much as possible, and throw your whole weight upon the hinder. As there are some horfes which, from weaknesses in their make, can never be brought to form a juit and beautiful flop, there are others which are apt to flop too suddenly and short upon their shoulders, though otherwise too much raised before and too light. These employ all their powers in order to flop all at once; these horfes should never be made to go backward; but, on the contrary, should be flopped slowly and by degrees, that they may be embossed, but they should never be forced or kept in too great a degree of subjection. The lefion of making a horfe to flop upon his haunches is admirable, if it be practiced with horfes which have been supple and prepared; but it should never be used to colts or raw horfes, whose joints are fiff.

The most certain method, says Mr. Berenger, to unite and assemble together the strength of a horfe, in order to give him a good mouth, to fix and place his head, as well as to regulate his shoulders, to make him light in the hand, and capable of performing all sorts of airs, depends entirely upon the perfection and exactness of the flop. The qualities above
above enumerated are essential to the flrop, and the flrop must be considered as the effect, and not as the cause of these good qualities. Berenger’s Hist. and Art of Horsemanship, vol. 11, chap. 5.

The opposite term to flarp is parting. In former times, the flop of a horse was called parade. See NAIL.

STOP, Half a, is a flop not finished by a peyade; so that the horse, after fasclading three or four times upon the haunches, refumes and continues his gallop, without making peyades or corsets; which fee.

STOP, at Sea, a word used by him that holds the half-minute glass, in hearing the log; for immediately when the glass is out, he calls flop to them that let run the line. See STOPPING.

STOP, in the Practice of Rigging, is a temporary lashing. When used to stop worning, it is snaked. This is a name given to several turns of spun-yarn taken round the end of a rope, similar to a lashing, to fasten it to another rope. Also, a projection left on the upper part of top-gallant masts, etc., to prevent the rigging from fliding down.

STOP, Saturday. See Saturday.

STOP is a floating beam, used to stop and detain barges at the toll-houses, when necessary, and during the night.

STOP-Gates are similar to Safety-gates, but they require to be fitted up, instead of acting of themselves. Stop-Planks are planks put into a groove, and serving the same purpose with stop-gates.

STOPCOCKS, in Hydraulics, are appendages to pipes constructed for the conveyance of fluids, and these, as well as valves, differ in their form and construction according to their various situations and uses. Stopcocks usually consist of a cylindrical or conical part, perforated in a particular direction, and capable of being turned in a socket formed in the pipe, so as to open or shut the passage of the fluid, and sometimes to form a communication with either of two or more vessels at pleasure. A valve is employed where the fluid is allowed to pass in one direction only, and not to return. See VALVE.

STOPPE, or STOP, in Mining. When a sumph or pit is sunk down in a lode, they break and work it away in stairs or steps, which method of working is called floping; and the height of step which each man breaks, is called a flop.

STOPPIN, a term in use at the military laboratory, derived from the French word stoppin, and signifying a wad, lump, clew, or bobbin of hemp, tow, rope-yarn, &c.

STOPPAROLA, in Ornithology, the name of a bird of the lark kind, described by Aldrovandus, and supposed by Mr. Ray to be the same with the pipollaia, or the toroia of the Venetians; but the muscicapa grifola of Linneus. See FLY-catcher.

STOPPEL, in Geography, a town of Flanders; 5 miles N.W. of Hulft.

STOPPERS, in a Ship, certain short pieces of rope, which are usually knotted at one or both ends, according to the purpose for which they are designed. They are either used to suspend any heavy body, or to retain a cable, hroudb, &c. in a fixed position. Thus, the anchors, when first hoisted up from the ground, are hung to the cat-head, by a stopper, called “anchor-stopper”, attached to the latter, which passing through the anchor-ring, is afterwards fastened to the timber-head; and the same rope serves to fasten it on the bow at sea; or to suspend it by the ring which is to be flunk from the ship to the bottom. The floppers of the cable have a large knot and a lannard at one end, and are fastened to a ring-bolt in the deck by the other. They are attached to the cable by the lannard, which is flanned securely round both by several turns passed behind the knot, or about the neck of the flopper; by which means the cable is restrained from running out of the ship, when the gades at anchor.

Those that are used to check the cable are called “bitt-floppers,” and the latter are denominated “deck-floppers.” “Dog-floppers” are used as additional securities when the ship is rising in heavy gales, or bringing up a ship with much stern-way, to prevent the cable from slapping at the bitts, and to safe the deck-floppers. “Wing-floppers” are used for the same purpose as dog-floppers.

The flippers of the hrouds, called “hroud-floppers,” have a knot and a lannard at each end. They are only used when the hrouds are cut adier in battle, or disabled by capricious weather; at which time they are lashed in the same manner as those of the cables, to the separated parts of the hroud, which are thereby reunited, so as to be fit for immediate service. This, however, is only a temporary expedient.

“Fore-tack” and “sheet-floppers” are used for securing the tacks and sheets, till bayed. Falconer.

STOPPER-BOLTS, in Ship-Building, large ring-bolts driven through the deck and beams, before the main hatchway, for the floppers to be attached to. They are carefully clenched on iron plates beneath.

STOPPING, in Grammar. See Point and Punctuation.

STOPPING, among Horses, the practice of filling the hollow of a horse’s foot with poultice, cow-dung, or any other moist application. It has the effect of softening the sole, and, on some occasions, may be advantageous, though it is frequently misapplied, and of course does injury. It is not unfrequently employed for the feet of team-horses, especially those of the plough kind, as travelling so much amid the mould renders them hard, brittle, and unsteady.

STOPPING a Leak, at Sea. See STOP.

STOPPING a Ship. When a ship comes to an anchor, and the cable is veered out by degrees till the ship is found to ride well, and then flopped, it is called flopping the ship.

STOPPINGS-Up, in Ship-Building, the pommets, timber, &c. used to fill up the vacancy between the upper side of the bilgeways and the ship’s bottom, for supporting her when launching.

STOPS, in Grammar. See Point.

STOPS of an Organ. See Organ.

STOPS, or STOP, in Rural Economy, a term provincially applied to small well-buckets, and those of some other kinds.

STOR, in Geography, a lake of Sweden, in the province of Glefricia; 6 miles S.W. of Gefle. — Alto, a lake of Norway, in the province of Aggerhuus; 40 miles N.E. of Chrifinia. — Alto, a river of Mecklenburg, which runs from lake Schwernin to the Elde.

STORA, a town of Sweden, in the government of Wafa; 20 miles S.E. of Christiansted.

STORA. See SOGATA.

STORAX-TREE, in Botany. See STYRAX.

STORAX, Official, in the Materia Medica, is the resinous drug, obtained in perfection only from those trees that grow in Asiatic Turkey, which issues in a fluid flate from incisions made in the bark of the trunk, or branches, of the storax-tree. It is brought from Turkey, but is so adulterated, that it is very difficult to meet with any that is pure. It has a most pleasing fragrant odour, and is called STYRAX CALAMUS, because it is said to be transported in hallow cans; or, according to others, because it exuded from the tender twigs and young shoots of the tree, and costed...
them over, so as to resemble a reed or other hollow cylindric body drawn over the twigs. Two kinds of this resin have been commonly distinguished in the shops; viz., the pure and the common flora, the first, or pure, is usually obtained in irregular compact masses, free from impurities, of a yellowish or reddish-brown appearance, and interfered with with whitish tears, somewhat like gum ammoniac or benzoin; it is extremely fragrant, and upon the application of heat readily melts. This has been called “florax in the lump,” “red florax,” and the separate tears, “florax in the tear.” The common florax is found in large masses, very light, and bears no kind of external resemblance to the former florax, as it seems to be almost wholly composed of dirty sawdust, merely caked together by the resinous matter; and though much less esteemed than the pure kinds of florax, yet when freed from the woody part, it is said to produce more fragrance, and to be superior to the other kind. Rectified florax, the common menstruum of refining, readily dissolves the florax, which may be inspissated to a solid consistency in the manner directed for the “flyracis purificatio” in the London Pharmacopoeia, without fouling any considerable loss of its sensible qualities. Common florax, infused in water, imparts to the menstruum a yellow colour, some share of its smell, and a slight balsamic taste. It gives a considerable impregnation to water by diffillation, and strongly diffuses its fragrance when heated, though it scarcely yields any essential oil. The spirituous solution, gently distilled off from the filtered reddish liquor, brings with it very little of the fragrance of the florax; and the remaining infusion is more fragrant than the finest florax in the tear, which Dr. Lewis met with. The pure resin distilled without addition yields, along with an empiric aromatic oil, a portion of salve matter, similar to the flowers of benzoin; and Dr. Lewis says, that he has also sometimes extracted from it, a substance of the same nature by cogging in water.

Of some of the ancients, florax was a familiar remedy as a resolvent, and particularly used in catarrhal complaints, coughs, asthma, menstrual obstructions, &c.; and from its affinity to the balsams, it was also prescribed in ulcerations of the lungs, and other states of pulmonary consumption. And our Pharmacopoeia formerly directed the “pulvus e florace” (see Storax Filla); but this odoriferous drug has now no place in any of the official compouds; and though it be a medicine which might seem to promise some efficacy in nervous debilities, yet it is almost totally disregarded by modern practitioners. Lewis’s Med. Med. Woodville’s Med. Bot.

Storax, Liquid, is a resinous juice, obtained from a large tree, with leaves like those of the maple, called by Ray “flowers acris folio,” by Linnaeus liquidambar flavicrus, a native of Virginia and Mexico, and lately naturalized to our own climate. The juice called liquidambar, is said to exude from incisions made in the trunk of this tree, and the liquid florax to be obtained by boiling the bark or branches in water. See Liquidambar.

“Two sorts of liquid florax are distinguished by authors: one, the purer part of the resinous matter that rises to the surface in the liquid florax, separated from the florax, and of the presence of honey, tenacious like turpentine, of a reddish or ash-brown colour, moderately transparent, of an acid undulating taste, and a fragrant smell, resembling that of the solid florax, but somewhat disagreeable; the other, the more impure part, which remains on the strainer, untransparent, in smell and taste much weaker, and containing a considerable portion of the substance of the bark. That which is commonly met with in the shops under this name, is of a weak smell and a grey colour, and is supposed to be an artificial complexion. Liquid florax has been chiefly used in external applications. Among us, it is at present almost wholly in dilute. Lewis’s Med. Med.

Storax, White. See Balsamum Persicifolium, under Balsam.

STORCICA, in Geography, a town of Poland, in the part of Kiev; 24 miles S.S.W. of Biala. Storck, Anthony, in Geography, a medical professor of considerable note at Vienna, succeeded the celebrated Van Swieten in the office of president and director of the faculty of medicine in the university of that metropolis, and was also honoured with the appointment of principal consulting physician to the empress Maria Theresa. He distinguished himself chiefly by a long and aulicious course of experiments relative to the operation of various narcotic vegetables, and to the best mode of preparing and administering them. The vegetables of which he has treated in various tracts, are the hemlock, henbane, Atromonium, aconite, meadow-saffron, and pulsatilla nigricans: and although he was disposed to over-rate the efficacy of some of these substances, and has ascribed to them virtues which subsistent experience has not always confirmed, he had the merit of calling the attention of the medical world to a class of active remedies, which, under proper management, are productive of much benefit, and constitute a valuable addition to the Materia Medica. Between the years 1760 and 1771, his various tracts upon these subjects were printed at Vienna, and they have subsequently undergone several editions and translations in other countries. He was also author of a collection of cafes which occurred under his observation in the hospital at Vienna, entitled “Anna Medicus, quo factuntur Observationes circa Morbus acutos et chronicos,” 1759; of which he published an “Anna Secundum” in 1761. This work was afterwards continued by his successor, Dr. Colin. In 1775, he published a volume, entitled “Instituta Facultatis Medicarum Vindobonensiae.” Eloy Diet. Hist. de la Mé.

STORDALEN, in Geography, a town of Norway; 28 miles N.E. of Drontheim.

Store, a town of America, in North Carolina; 50 miles W. of Exeter.

Store, Bill of Stores. See Bill.

Store, Naval. See Naval.

Store-House, in Agriculture, that fort of house or building which is constructed for the purpose of storing up and preserving some sort of farm produce, which should be constructed suitably to the particular kinds of products they are to contain, and to the uses to which they are to be applied.

Houses of this kind are sometimes also employed for storing and laying up different sorts of small tools and implements, and many other things which are necessary in farming, in order to keep them safe and dry.

They are seldom used for any sort of grain, especially for any length of time, as that requires a particular sort of building. See Granary.

The store-houses of a fortress are constructed for the preservation of all kinds of artillery and ammunition; those of a dock-yard, or of a maritime town, for cables, anchors, timber, and other necessaries, to repair and furnish ships. And they are of different forms and sizes, according to the purposes for which they are intended.

Store-Room, in Rural Economy, a room or place in a house or other building, for storing up different sorts of farm articles. These rooms should be as dry as possible, and perfectly secure from vermin. An upper floor is the best.
bent for the first purpose; but for the latter, vaults or cellars under ground are the most suitable.

Store-Room, in a Ship, an apartment or place of reserve, of which there are several, to contain the provisions or stores of a ship, together with those of her officers, during a sea-voyage.

Store-Keeper, an officer in the royal dock-yards, who is invested with the charge of the principal naval stores; as the falls, anchors, cordage, &c.

Store-Master, in Agriculture, a term applied to that kind of farmer who is, in a great measure, in the live-flock kind of farming in some way or other, as either by means of sheep, neat cattle, or some other fort of domestic animals.

Store-Ship. See Store-SHIP.

STOREA, among the Romans, a kind of basket made of ropes or rushes, for gathering flowers or garden-fruit.

STOREA was likewise a kind of defence, made of large cables fastened into a sort of netting; which was so strong, that no weapon, though thrown out of an engine, could penetrate it.

STORGE, ἰερός, a Greek term, frequently used by naturalists to signify that parental instinct, or natural affection, which animals bear toward their young.

The storae is an admirable principle implanted by the all-wise Creator throughout the animal world, for the preservation of it; and is governed by such rules as make it best contribute thereto. By means of this, with what care and minuteness do animals nurture their young; and what dangers will they brave for their security; even the most timorous creatures, which at other times fly the face of men, dogs, &c. will, for the sake of their young, expose themselves. Thus hens, instead of flying from, will assault such as meddle with their brood; and partridges, before their young can fly, will frequently drop down before the dogs, first at leis, then at greater distances, to dodge and draw them off from pursuing their young.

With what concern do others lead about their young in places of safety; and some even admit them for their part into their beds. Thus the heron, which, as Tyron observes, has a curious bag on purpose for securing and carrying about her young. The same author adds, from Oppian, that the dog-fish, upon any storm or danger, receives her young into her belly, which comes out again when the fright is over. And it is said that the squatina and glaucus do the like.

With what tenderness do others seek and prepare the food for their young, teach them to suck, cherish, or lull them to rest, &c. like so many nurses, deputed by the Creator to take care of his creatures? and fill in proportion, as they grow up, and become fit to look to themselves, this storae abates; and at length, when no longer needed, becomes extinct. Mr. Ray observes, that young doves are fed with meat first eat by the dam, and sodden awhile in her prolube. And Clusius observes, that the old female Ethopian takes no food but from the male, after this manner.

The returns made by the young to the parent animal, when grown old, are not less considerate. Pliny says of rats, that they nourish their aged parents with eminent piety.

St. Ambrose, and after him Olaus Magnus, observe of the crane, that when the parents, through old age, are bereft of their feathers, and left half naked, their offspring stand around them, and cherish them with their own feathers; that they seek food for them; and when nature, as it often happens, repairs their decays, and restores them to strength again, they take them up, by turns, on their wings, and habituate their unpractised limbs to their ancient art of flying. See Instinct.

STORHAMNEN, in Geography, a small island on the W. side of the gulf of Bothnia. N. lat. 61° 32'; E. long. 17° 13'.

STORHOLMEN, a small island on the W. side of the gulf of Bothnia. N. lat. 62° 34'; E. long. 17° 42'.

STORING, Substances of the Corn, Fruit, and other Kinds, in Agriculture and Gardening; the means of advantageously and properly laying them up and securing them for future use.

In the storing of grain, as there is a constant decrease and loss in the weight of the corn from the moment of its being laid up, to that in which it is disposed of, (though this is considerably more at first than afterwards,) it is obviously a practice that should be carried to as little extent as possible in all cases. The common lois in this way has been found to be from one-seventh to one-tenth of the whole in different parts of corn, according to circumstances, and the length of time it has been stored up.

The storing of all articles of this kind should always be performed at dry times, and in dry well-aired places, and not laid in too large quantities together, but so as that they may be capable of being readily turned over, and have new surfaces frequently exposed to the action of the atmosphere. Corn is often not only injured, but rendered improper for storing up, by being suffered to remain too long on moist damp floors, in barns and other places.

The storing of fruits, vegetables, and roots, has been performed in various ways, which are well known already; but lately some better modes have been suggested for this purpose.

For apples and pears, it has been stated in the "Memoirs of the Caledonian Horticultural Society," that after they have been carefully gathered from the trees, and laid in heaps covered with clean cloths or mats for sweating, which is effected in three or four days, they remaining for that length of time afterwards, they are to be wiped separately with clean cloths; when some glazed earthen jars are to be provided with tops or covers, and likewise a quantity of pure pit-fand, which is quite free from any mixture. This is to be thoroughly dried upon a flue. Then put a layer of this sand an inch thick on the bottoms of the jars; above this a layer of fruit, a quarter of an inch free of each other; covering the whole with sand to the depth of an inch; then a second course of fruit is to be laid in, and again covered with an inch of the sand, proceeding in the same way until the whole be finished and completed. An inch and a half in depth of sand may be laid over the last or uppermost layer of fruit; when the jars are to be closed and placed in some dry situation, as cool as possible, but entirely out of the way of frost.

The usual time at which each kind of such fruits should be ready and fit for the table being known, the jars containing such fruit may, it is said, be examined, by turning out the sand and fruit together cautiously into a sieve. The ripe fruit may then be laid upon the shelves of the fruit-room for use, and the unripe be carefully replaced in the jars as before; but with fresh dry sand.

Some kinds of apples managed in this way, will, it is said, keep a great while, as till July; and pears until April, and in some parts till June. It is not improbable but that many other sorts of fruit might be stored and preserved in somewhat the same way.

Vegetables of the cauliflower kind have been stored and kept well through a great part of the winter, it is said, in the same work, by putting them, when in full head,
on a dry day, into pits about eighteen inches in depth, and much the same breadth, in a perfectly dry foil, with the stalks and leaves to them, the latter being carefully doubled over and lapped round the heads, instead of hanging them up in sheds or other places, as is the usual practice in preserving them. In performing the work, it is begun at one end of the pits, laying the heads in with the root-stalks uppermost, so that the former may incline downwards, the roots of the one layer covering the tops or heads of the other, until the whole is completed. The pits are then to be closely covered up with the earth into a sort of ridge, and beaten quite smooth with the back of the spade, in order that the rain-water may be fully thrown off. Fine cauliflowers have been thus stored and kept for the occasional supply of the table until the middle of the following January.

For storing and preserving different kinds of roots for common summer use, until the coming in or return of the natural crops, the following method has likewise been proposed. As the ice in ice-houses has commonly furnished for food, as four, five, or more, by the beginning of the spring, it is proposed to deposit in the rooms or vacancies so left empty, the roots that are to be preserved. As soon as any openings in the places have been well stuffed with straw, and the surfaces of the ice covered with the sort of material, cafe-boxes, dry ware, caffs, baskets, or any other such vessels, are to be placed upon it, which are then to be filled with the roots, such as turnips, carrots, beets, celery, potatoes in particular, and some others.

In cities where there are not ice-houses, vegetation may be greatly retarded, and the roots preserved by storing them in deep vaulted cellars, caves, coal-pits, mines, or in any place heated deep in the earth.

Potatoes have also been well floored and preserved, it is said, by earthing them in small parcels, as about two balls each, heaped up, and covered in the usual way with straw and earth; which are turned over into other pits in the early spring, first rubbing off all the sprouts or shoots, and having the roots well watered in small quantities as they are put into the other pits, the whole earthy covering being also well watered and beaten together at the time with the back part of the spade. This covering is to be made to the thickness of about two feet. The same practice or process is to be repeated every time the potatoes are turned over, which should be about once in three weeks, as the state of the weather may be. And where the pits or heaps are not in the shade, it is sometimes proper, when the season is very hot, to cover them with mats supported on sticks, so as to permit a free current of air between the mats and the heaps.

In this way, it is stated that these roots have been preserved quite plump and entire in the earth until the end of September, or till the succeeding crop becomes perfectly ripe, so as to be used without loss, as it must always be the case where the roots are largely employed before they are in a state of mature growth. It is asserted, too, that in this manner potatoes are even capable of recovering in plumpness and tattle, where they have been suffered, by improper exposure to air or heat, to become deficient in these qualities.

**STORK, Ciconia, in Ornithology, a family of the Ardea or Heron class. See Heron. Naturalists have been much puzzled in assigning the winter abode of storks. Many authors have supposed that they go to the Nile at this feast in quest of food; to which purpose Dr. Shaw observes, that in the middle of April he saw three flights of these birds, each of which took up more than three hours in passing by him, extending itself more than half a mile in breadth. These, he says, were then leaving Egypt, where the canals and the ponds that are annually left by the Nile were become dry, and directing themselves towards the north-east. He adds, that they return again a little after the autumnal equinox, when the waters of the Nile returning within the banks, leave the country in a fit state to supply them with nourishment. But M. Klein counters the opinion, that storks visit Egypt in the winter in search of food; observing, that if this were the case, they would not go in the winter, and remain until April, but in the summer; for the inundation of the Nile begins towards the end of April, and about the month of September the waters diminish, and about the 7th or 8th of October quite retire into their channel, so that in the winter this river is extremely small; and he apprehends that they take up their winter-quarters under water.

It is observed of the storks, says Dr. Shaw, that for the space of about a fortnight before they pass from one country into another, they constantly resort together from all the circumjacent parts in a certain plain, and there forming themselves daily into a dou-wanne (according to the phrase of the people), are paid to determine the exact time of their departure, and the places of their future abodes. See Jer. chap. viii. ver. 7.

The stork is held in the highest esteem and veneration among the Mahometans, with whom it is no less sacred than the ibis was among the Egyptians; and no less profane would that person be deemed, who attempted to kill or molest it. The regard paid to these birds, Dr. Shaw says, may probably have arisen, not so much from the service they perform to a moiff fenny country, in clearing it of useless reptiles and insects, as from the solemn festivities they are observed to make as often as they rest upon the ground, or return to their nests. Shaw’s Travels, p. 428, fol.

**STORKAGAT, in Geography, a town of Sweden, in Weit Bothnia; 25 miles S. of Pitea.**

**STORKÖ, a small island on the E. side of the gulf of Bothnia. N. lat. 63° 52'. E. long. 23° 59'.—Albo, an island in the Baltic, near the S. coast of Sweden. N. lat. 56° 5'. E. long. 15° 34'.**

**STORKOW, a town of Brandenburg, in the Ucker Mark; 26 miles W.S.W. of Francfort on the Oder. N. lat. 52° 15'. E. long. 14° 55'.**

**STORKYRO, a town of Sweden, in the government of Vasa; 17 miles E. of Vasa.**

**STORM, in the Military Art. See Assault.**

**Storm, in Rural Economy, a term signifying a fall of snow, hail, &c. which is injurious either to animals or plants.**

In some districts, storms of these kinds are very prevalent, and highly hurtful in different ways. In the sheep farms in the northern parts of the island, storms are often extremely hurtful and destructive to the sheep. They are the most fatal to these animals, it is said, when the frosts is keen, the wind strong, and the snow light and mobile; as then the defenceless flock move before the blast, into some hollow part or place, where they find a little relief from the piercing storm, but are covered up deep with drifted snow, and when long confined underneath it, many of them perishing, and those which survive are often much reduced in condition, and sometimes have lost part of their wool. And though this place of retreat be near a rivulet, as often happens, and a sudden thaw come on, the melted snow brings down a torrent of water on them, and they all perish.
Smooth green hills, that are destitute of rocks, woods, or other shelter, are, it is thought, the moat in danger for the sheep on them, from the drifting snow. The sheep, in these cases, are to be collected, and kept moving, in order to prevent their being benumbed with the cold, and overblown by the drifting snow. Stone fields are also useful; but the true and effectual shelters are, it is said, plantations of forest trees, to which the sheep naturally fly on the approach of storm. See SHORE.

Storm Bay, in Geography, a bay on the south coast of New Holland, between South Cape and Tasman's Head.

Storm Cape, is the northern limit of the mouth of Bay Verte, and forms the south-east corner of the province of New Brunswick.

Storm-Finch, or Storm-Finch, in Ornithology. See Procellaria Pelagica.

STORMAR, or Stormaria, in Geography, a district of the duchy of Holstein, of which Hamburg is the capital. The Stor, whence it derives its name, confined this district on the north, and separated it from Ditmaria: the Sula, Trave, and Billa, determined the rest of its extent. It was formerly almost one slimy marsh. The land and low situation of Stormaria and Ditmaria exactly corresponds with the Roman account of the Saxons living in inaccessible marshes. Stormaria is somewhat quadrangular, and its sides may be estimated at 33 miles. Adam Bremen derives the name from Stor, a metaphor expressive of the feddins of its inhabitants; but Stor, the river, and Mark, the inhabitants in marshes, seem to compose a juter etymology. Adam distinguishes the Stormarii by the epithet *nobiles*, Their banner, in ancient times, was a white swan with a golden collar. Hamburg, their metropolis, had been, before the eleventh century, *viris et armis potens*; but in Adam's time it was *in solitudinem redacta.* Stormaria was one of the three districts which, in the eleventh century, divided Norderlinga, or Eld-Saxsen; Ditmaria and Holstia being the two other districts. These were the countries in which our Roman ancestors resided, and in which they spread terror throughout Europe, when their attention became directed to maritime depredations.

STORMONT, a district of Scotland, in Perthshire, on the left side of the Tay. Dunkeld is the chief town.

STORMONT, a county of Upper Canada, bounded east by the county of Glengary, south by the river St. Lawrence, the west boundary of the township of Oinabrack, and west by the late townships of Williamburgh, running N. 24° 11' W., until it intersects the Ottawa or Grand river; thence descending that river, until it meets the north-west boundary of the county of Glengary. The county of Stormont comprehends all the islands in the river St. Lawrence near it, and the greater part of the country lies fronting the St. Lawrence.

STORINA, in Ancient Geography, a town of India, on the other side of the Ganges, belonging to the people called Tanganis, according to Ptolemy.

STORINARA, La, in Geography, a town of Cappadocia; 9 miles N.E. of Ancyli.

STORNAWAY, a parochial town on the eastern side of the island of Lewis, and isle of Rona, Scotland. It contains a good and well-frequented harbour. The parish is of great extent, and stretches about ten miles north-east, along the north side of an arm of the sea, called the Broad Bay. In this, ships of large burthen have good anchorages, and can ride with safety, as no heavy sea can come into it. The town of Stornaway is situated at the extremity of loch Stornaway; and, from a small origin, has of late attained considerable size and opulence, by the patriotic exertions of Lord Seaforth. The principal employment of the inhabitants of Stornaway is the prosecution of the white and herring fisheries. It is a port of the customs, and has a post-office, and regular packet, which calls weekly with the mail and passengers. The houses of the town are generally well built, and, in 1811, amounted to 698, with 3500 inhabitants. Here are a neat and commodious custom-house, a town-house, assembly-room, and a church, also two free schools, and one instituted and patronized by lady Seaforth, for the introduction and promotion of the spinning of yarn in the island of Lewis. In Stornaway is also situated Seaforth Lodge, the residence of lord Seaforth, baron Mackenzie of Kinital, and lord lieutenant of the shire.—Carlisle’s Dictionary of Scotland, vol. ii. Beauties of Scotland, vol. v.

STORO, a small island on the east side of the gulf of Bothnia. N. lat. 63° 24'. E. long. 22° 3'.

STOROHAMN, a small island on the west side of the gulf of Bothnia. N. lat. 60° 17'. E. long. 17° 53'.

STOROZEVIOI, a cape on the north coast of Russia, in the straits of Vaigatchko. N. lat. 60° 24'. E. long. 86°.

STORSIO, a large lake of Sweden, in the province of Jamland; containing several islands, on one of which is the town of Frolon, and on the other town of Norderfl. It has a communication with many other lakes and rivers, and by means of these with the gulf of Bothnia. N. lat. 63° 10'. E. long. 14° 10'.

STORSKAR, two small islands on the east side of the gulf of Bothnia. N. lat. 63° 33'. E. long. 20° 43'.

STORT, a river of England, which passes by Bishop's Stortford, &c. and runs into the Lea, 2 miles N.E. of Hoddesdon.

STORTA, LA, a town of the Patrimonio, near the ruins of the ancient Veii; 6 miles N.W. of Rome.

STORTFORD, Bishop's. See Bishop's Stortford.

STORPYNE, the name of an instrument used by the ancients for drawing blood from the nose; but we are not perfectly informed of its shape or structure.

STOSSEN, in Geography, a town of Saxon, in Thuringia; 6 miles S.E. of Naumburg.

STOT, in Rural Economy, a provincial term applied to a heather, or young growing bullock.

STOTFIELD HEAD, in Geography, a cape of Scotland, on the coast of Murray. N. lat. 57° 42'. W. long. 3° 10'.

STOTTER SEE, a lake of Bavaria, in the bishopric of Augsburg; 10 miles N.N.W. of Fufellen.

STOTTLEDORF, a town of Austria; 6 miles S. of Sonneberg.

STOVE, in Building, a hot-house or room. The term stove is also used more restrictively for a place in which fire is made, and by means of which heat is communicated to a room or building. See CHIMNEY.

Stoves should, in propriety, be distinguished from fireplaces, from the fire being inclosed within the stove, and giving out its heat through the substance of the materials of which the stove is composed, to the air in the apartment; and in many stoves there are ingenious contrivances, to make a great quantity of air pass in contact with the heated surface of the stove, and be thus heated before passing off into the apartment. Fireplaces, on the contrary, have the fire as open and as much exposed as possible, sufficiently with the carrying off of the smoke, in order that it may throw out radiant heat into the apartment. This distinction is not sufficiently attended to in common language.
STOVE.

In modern fire-places, every care is taken that the air of the room may be heated; but it does not appear, from the construction of their fire-hearth, that our forefathers had any idea of warming the air of a room to fit in. All they proposed was to have a place to make a fire in, by the radiating heat of which they could warm themselves when cold.

The ancients are supposed to have used stoves, in which the fire was not seen; but on inquiring into the progress of the art of warming apartments economically, few traces remain of the manner in which the ancients warmed their habitations. It is imagined they lighted the fire in a large tube in the middle of a room, of which the roof was open, and that the other apartments were warmed by portable braziers. In Seneca's time, they began to construct tubes in the walls, to convey the heat into the upper apartments; the fire-places being full placed below. It appears, however, that this was the origin of stoves for smoking, and even of stoves; the situation and proportions of which have successively undergone an infinity of changes, according to the localities, the wants of the inhabitants, or the style of the decorations.

The ancients had the custom of heating apartments by fires placed under archs or vaults; but this was confined to palaces, and other edifices, where magnificence was augmented by prodigality; and the apartments have been discovered in ancient ruins. Dr. Franklin pointed out this as their definition. In digging, some years ago, for foundations in the city of Autun, one of these ovens was discovered under a mosaic pavement, with chimneys at each extremity.

The northern Chinese have a method of warming their ground-floor, which resembles the ancient plan just mentioned. The floors are made of tiles a foot square, and two inches thick; their corners being supported by bricks set on end, that are a foot long, and four inches square; the tiles, too, joined into each other, by ridges and hollows along their sides. This forms a hollow under the whole floor, which on one side of the house has an opening into the air, where a fire is made; and it has a funnel rising from the other side to carry off the smoke. The fuel is a sulphurous pit-coal, the smell of which in the room is thus avoided, while the floor, and of course the room, are well warmed. But as the under-side of the floor must grow foul with foot, (and a thick coat of foot prevents much of the direct application of the hot air to the tiles,) Dr. Franklin suggests that burning the smoke, by obliging it to descend through the red coals, would, in this construction, be very advantageous; as more heat would be given by the flame than by the smoke, and the floor, thereby being kept free from foot, would be more heated with less fire. A different kind of stove used in China, and called Zang, is briefly described under that article.

Francis Kellar of Frankfort, whose work, entitled "Eargove-bois," &c. (The wood-faver, &c.), appeared, in French, in 1619, is the eldest writer who defers to be quoted, having proposed any useful laws on the subject of stoves. He formed eight chambers, one above another, through which the smoke was to pass before it entered the chimney. He also brought air directly from without into the ash-pan, to feed the fire; and there was another aperture to draw air from the apartment for the same purpose.

Savoy, in his "Architecture Francaise des Batimens particuliers," i.e. Architecture of private Houses, printed in 1625, gave some advice relative to the best method of contructing chimneys, but with scarcely any other object than to prevent their smoking.

M. Daleme, in 1686, suggested the first idea of a stove without smoke, which he called furus acupina. Here the smoke is forced to descend into the fire-place, where it is consumed. Dr. Franklin, who afterwards executed a very complete stove on that principle, still spoke of it, in 1773, as a mere curiosity or philopohical experiment, as it required too much attention to be managed by common servants.

This machine consists of a tube of iron-plate, such as is used for the flue of a German stove. This tube was bent at right angles, and the part which was horizontal was about two feet in length, and joined to the rest of the tube, which ascended vertically. At the opposite end of the horizontal tube the furnace was made: it consisted of a cylindrical tube of plate-iron erected upon the horizontal tube near the end, and provided with a gratings, upon which the fuel was placed; and the grate prevented the fuel falling down into the horizontal tube. To light this stove, some clear burning charcoal was put into the large short tube or furnace, and supported on the grate. As soon as the tubes grew warm, the air within them would ascend in the perpendicular tube or chimney, and go out at the top of it: fresh air must enter into the horizontal tube through the furnace. In this course it must descend through the burning fuel, and becoming heated by the burning coals, through which it has passed, would rise more forcibly in the longer tube, in proportion to its degree of heat, or rapid, according to the situation and length of that tube. Such a machine is a kind of inverted siphon; and as the greater weight of water in the longer of the common siphon, in descending, is accompanied by an ascension of the same fluid in the shorter; so in this inverted siphon, the greater quantity of levity of air in the longer leg, in rising, is accompanied by the descent of air in the shorter. The things to be burnt being laid on the hot coals contained in the furnace, the smoke must descend through those coals, and be converted into flame, which, after destroying the offensive smell, comes out at the end of the longer tube, as mere heated transparent gas or vapour.

Whoever would repeat this experiment with success, must take care that the part of the short tube is quite full of burning coals, so that no part of the smoke may descend and pass by them, without going through them, and being converted into flame; and that the longer tube is so heated, that the current of ascending hot air will be established in it, before the things to be burnt are laid on the coals; otherwise there will be disappointment.

It does not appear, either in the Memoirs of the Academy of Sciences, or Philosophical Transactions of the English Royal Society, that any improvement was ever made of this ingenious experiment, by applying it to useful purposes; but there is a German book, entitled "Vulcanus Famulans," by Joh. George Leutmann, P.D., printed at Wurtzberg in 1723, which describes, among a great variety of other stoves for warming of rooms, one which seems to have been formed on the same principle. It was probably taken from the Chinese, although M. Daleme's experiment is not mentioned; for the construction is as nearly as possible the same, except in the proportion of parts; the furnace being made in the form of a basin or vase, having the grate in the bottom of it.

Gauger, author of "Le Mechanisme du Feu," &c., printed at Paris in 1709, was the perfom to whom we are indebted for the first and most complete system of experiments on the circulation of heat, by means of air-holes affording warm air; as also the manner of making one fire warm several rooms, and to send off the heat in elliptic curves.
curves. We there find a description of a chimney, with the back, the hearth, and the jamb, of hollow iron, to heat the air that is to enter the room. But it does not appear that this work produced much effect at the time; the most important truths lie concealed in books, till some preying interest awakens the attention of mankind to their utility.

Dr. Franklin, in 1745, published an account of the new fires of Pennsylvania; the advantages of which he compares with those of the fires of Germany and Holland, and the chimney of Gauger. A description and drawing of this stove are given in our article Fire-Place.

In 1785, Dr. Franklin published the description of another stove, which has the flame reversed; that is, it paffes downwards through the fuel. The appearance of this stove is that of a vase of cast-iron, with its pedestal; and this is mounted upon the top or lid of an air-box, standing upon the hearth of the fire-place, and built close in a niche in the stone-work; but the vase being wholly detached from the back of the niche, has a very neat appearance. The top of the vase turns back upon a hinge, so as to open like a lid, to put in the fuel; and the opening is covered by a brafs frame, which allows the air to enter. The bottom of the vase has in it an opening, of about two inches diameter, which leads through the stem or foot of the vase into a hollow iron box, forming the pedestal. At the bottom of this pedestal is a grating in the lid or top of the air-box, upon which the vase stands. The air-box is divided by four partitions, between which the flame paffes and repaffes horizontally in a waving direction, until it escapes into the chimney. Thus the flame and smoke, immediately after it has descended through the grate in the top of the air-box, paffes backwards towards the chimney between the two middle partitions; but as it cannot enter into the chimney at that part, it turns round the ends of these partitions, and returns in two currents towards the front of the box; then returns again round the end of other partitions, and goes back into the chimney, which is behind, or rather at the sides of the niche, in which the vase stands. The front plate of the air-box is made to slide in a groove, in two pieces, which meet together in the front like folding-doors; and these pieces being folded back, expose the spaces between the partitions, which, as before mentioned, act as winding flues for the smoke to circulate in, and give out its heat through the metal of the air-box. In the space between the two middle partitions, and into which the smoke first descends, a drawer is fitted to receive the ashes or cinders, which may fall through the grate in the top of the air-box; and it can be readily withdrawn, to clear it out.

There is likewise a small grate at the lower part of the space, upon which the fuel contained in the vase will rest. When this fuel is lighted, the flame and smoke will draw downward, and, descending through the grate, will pass through the hole in the bottom of the vase into the hollow pedestal, and through the grate in the top of the air-box: it then paffes horizontally in the space between the two middle partitions of the air-box, and proceeds in the same direction towards the back of the chimney; there dividing, one turns to the right and paffes to the right end of the middle partition; then coming forwards, it turns round the near end of the outside partition; then moving backwards, it arrives at the opening into the bottom of one of the upright corner funnels behind the niche, through which it ascends into the chimney, thus heating that half of the box and that side of the niche. The other part of the divided flame paffes to the left, round the far end of the middle partition, round the near end of the outside partition, and so into and up the other corner funnel; thus heating the other half of the box, and the other side of the niche. The vase itself, and the box, will also be very hot; and the air surrounding them being heated, and rising, as it cannot get into the chimney, it spreads in the room; colder air succeeding, is warmed in its turn, rises, and spreads, till by the continual circulation the whole is warmed.

If there is occasion to make the fire when the chimney does not draw, it must not be begun in the vase, but in one or more of the passages of the lower air-box; first withdrawing the sliding front of the air-box, and covering the mouth of the vase. After the chimney has drawn some time with the fire thus low, and begins to be a little warm, those passages may be closed, and another fire kindled in the hollow pedestal, leaving its sliding shutter a little open; and when it is found that the chimney, being warmed, draws forcibly, that passage may be shut, and the vase opened, to make the fire there, as above directed. The chimney, well warmed by the first day's fire, will continue to draw constantly all winter, if the fire is made daily.

In the management of this stove, there are certain precautions to be observed, at first with attention, till they become habitual. To avoid the inconvenience of smoke, the grate must be cleared before beginning to light a fire. If it is found clogged with cinders and ashes, the grate must be lifted up with the tongs, to let them fall upon the grate in the top of the air-box; the ashes will go through it into the drawer, and the cinders may be raked off through a sliding door in the pedestal, and returned into the vase, when they are to be burnt. Care must be taken that all the sliding-plates are in their places, and closely shut, that no air may enter the stove but through the round opening at the top of the vase; and to avoid the inconvenience of dust from the ashes, let the ash-drawer be taken out of the room to be emptied. The passages should be cleaned or raked out, when the draught of the air is strong inwards; and the ashes must be put carefully into the ash-box, whilst it remains in its place.

If it is required to prevent the fire burning in the absence of the proprietor, it may be done by removing the brafs frame from the top of the vase, and covering the passage or opening into the top of the vase with a round tin-plate, which will prevent the entry of more air than barely sufficient to keep a few of the coals alive. When the fire is wanted, though some hours afterwards, by taking off the tin-plate, and admitting the air, the fire will soon be recovered.

The effect of this machine, well managed, is to burn not only the coals, but all the smoke of them; so that while the fire is burning, if the top of the chimney is observed, no smoke will be seen rising, nor any thing but clear warm air, which, as usual, makes the bodies feel through it appear waving.

But it must not be imagined from this, that it can be a cure for bad or smoky chimneys, much less that, as it burns the smoke, it may be used in a room that has no chimney. It is only by the help of a good chimney, and the higher the better, that it produces its effect at all; and though a plate of plate-iron sufficiently high might be made in a very lofty room, the management would prevent all disagreeable vapour would be too nice for common practice, and small errors would have unpleasing consequences.

It is certain that clean iron yields no offensive smell, when heated; whatever smell of that kind is perceived where there are iron stoves, proceeds, therefore, from some foulens burning or fuming on their surface; they should, therefore, never be left upon, or greased, nor should any dust
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Dust be suffered to lie upon them. But as the greatest care will not always prevent these things, it is well once a week to wash the stove with soap-lees and a brush, rinsing it with clean water.

The advantages of this revered flame in stoves are very considerable. The chimney does not grow foul, nor ever need sweeping; for as no smoke enters it, so no foot can form in it.

The air heated over common fires instantly quits the room, and goes up the chimney with the smoke; but, in the stove, it is obliged to descend in flame, and pass through the long winding horizontal passages, communicating its heat to a body of iron-plate, which, having thus time to receive the heat, communicates the same to the air of the room, and thereby warms it to a greater degree.

The whole of the fuel is consumed by being turned into flame, and the benefit of its heat is obtained; whereas, in common chimneys, a great part goes away in smoke, which may be seen as it rises, but it affords no rays of warmth. Some idea may be formed of the quantity of fuel thus wasted in smoke, by reflecting on the mass of foot that a few weeks' firing will lodge against the fides of the chimney; and yet this is formed only of those particles of the column of smoke which happen to touch the fides in its ascent. How much more must have passed off in the air? and we know that this foot is full fuel, for it will burn and flame as such; and, when hard caked together, is indeed very like and almost as solid as the coal from which it proceeds. The destruction of fuel goes on nearly in the same quantity in smoke as in flame, but there is no comparison in the difference of heat given. When fresh coals are first put on a fire, a considerable body of smoke arises. This smoke is, for a long time, too cold to take flame; but if a burning candle is plunged into it, the candle, instead of inflaming the smoke, will instantly be extinguishe. Smoke must have a degree of heat to be inflammable. As soon as it has acquired that degree, the approach of a candle will inflame the whole body, and the difference of the heat which it gives will be very sensible. A still easier experiment may be made with a candle itself. Hold your hand near the fide of its flame, and observe the heat it gives: then blow it out, the hand remaining in the same place, and observe what heat may be given by the smoke that rises from the still burning wick; you will find it very little: yet that smoke has in it the fulness of much flame and, if it be produced to you, if you hold another candle above it so as to kindle it. Now the smoke from the fresh coals, laid on this stove, instead of ascending and leaving the fire, while too cold to burn, being obliged to descend through the burning coals, receives among them that degree of heat which converts it into flame, and the heat of that flame is communicated to the air of the room, as above explained.

The flame from the fresh coals laid on in this stove, descending through the coals already ignited, preserves them long from consuming, and continues them in the state of red coals, as long as the flame continues that surrounds them, by which means the bars, crouching from the fides, are of much longer duration than in any other, and fewer coals are therefore necessary for the day. This is a very material advantage indeed. That flame should be a kind of pickle to preserve burning coals from consuming, may seem a paradox to many, and very unlikely to be true, as the doctor tells us it appeared to himself the first time he observed the fact: he therefore relates the circumstances, and mentions an easy experiment, by which his reader may be in possession of every thing necessary to the understanding of it.

In the first trial he made of this kind of stove, which was constructed of thin iron plate, he had, instead of the vase, a kind of inverted pyramid, like a mill-hopper; and fearing at first that the small grate contained in it might be clogged by cinders, and the passage of the flame sometimes obstructed, he ordered a little door near the grate, by which he could occasionally clear it; though after the stove was made, and before he had tried it, he began to think this precaution superfluous, from an imagination that the flame, being contracted in the narrow part where the grate was placed, would be more powerful in consuming what it should there meet with, and that any cinders between or near the bars would be presently destroyed and the passage opened. After the stove was fixed and in action, he had a pleasure now and then in opening that door a little, to see through the crevice how the flame descended among the red coals, and observing once a single coal lodged on the bars in the middle of the focus, he observed by a watch in what time it would be consumed: he looked at it long without perceiving it to be at all diminished, which surprised him greatly. At length it occurred to him, that he had seen the same thing a thousand times, in the conversion of the red coal formed in the snuff of a burning candle, which, while enveloped in flame, and thereby prevented from the contact of the passing air, is long continued, and consumed instead of diminishing, so that we are often obliged to remove it by the smoke, or else to blow the flame into the air, where it presently consumes to ashes. He then supposed, that to consume a body of air, passing air was necessary to receive and carry off the separated particles of the body: and that the air passing in the flame of the stove, and in the flame of a candle, being already saturated with such particles, could not receive more, and therefore left the coal undiminished as long as the outward air was prevented from coming to it by the surrounding flame, which kept in a situation somewhat like that of charcoal in a well-toted crucible, which, though long kept in a strong fire, comes out unconfumed.

This stove of Dr. Franklin is very ingenious, and has been much used in France, where the management of coal-fires is but little understood, and they are therefore induced to use stoves in preference to open fires, when they burn pitch-coals. Dr. Franklin completed the stove first described in 1771, and used it in London during three winters. While he was in France, he contrived another grate for burning pitch-coals, which has the same property of burning the smoke, and of the same time the fire is exposed in a grate. The grate is a short cylinder, with its axis placed horizontally, and the end turned towards the apartment; one of its circular ends being made with bars, and the other is a backplate: it is a foot (French) in diameter, and eight inches deep or long between the bars and the back; the fides and back are of plate-iron, the fides having holes of half an inch diameter, and three or four inches distant from each other, to let in air for enlivening the fire: the back is without holes, and the fides do not meet at either the top or bottom by eight inches; and this space is filled with grates at small bars, crooking from front to back, let in air below, and let out the smoke or flame above. The three middle bars of the front grate, that is, the circular end, are fixed; the upper and lower may be taken out and put in at pleasure, when hot, with a pair of pincers. The whole of this cylindrical grate turns upon pivots fixed in the opposite fides, across the centre of it: the pivots are supported by a crotchett, the stem of which is an inverted conical tube, five inches deep, which fits as many inches upon a pin, which is fixed upright in a cast-iron plate that lies upon the hearth. In the middle of the top and bottom grates are
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are fixed small upright pieces, about an inch high, which, as the whole is turned on its pivots, float it when the grate is perpendicular. By this means the grate can be inverted by turning it over upon its pivots, but as that will prevent the back-plate to the apartment, it requires to be turned half round horizontally upon the conical pin to bring the front bars to the room.

In making the first fire in the morning with this grate, there is nothing particular to be observed; it is made as in other grates, the coals being put into the cylindrical grate above, after taking out the upper bar, which must be replaced when they are in.

The round figure of the front bars filled with fire, when thoroughly kindled, is agreeable: it represents the great giver of warmth to our system. As it burns down, it leaves a vacancy above, which must be filled with fresh coals, the upper bar is to be taken out, and fresh coals thrown in, the bar being afterwards replaced. The fresh coals, while the grate continues in the same position, will throw up, as usual, a body of thick smoke; but every one accustomed to coal-fires in common grates must have observed, that pieces of fresh coal stick in below among the red coals, have their smoke so heated, as that it becomes flame as fast as it is produced, which flame rises among the coals, and enlivens the appearance of the grate. Hence the smoke be the use of his swivel-grate: by a push with the tongs or poker, it can be turned over on its pivots till it is inverted, and the front bars face the back of the chimney; then turn it gently round on its vertical socket or axis, till it again faces the room, whereby all the fresh coals will be found under the live ones, and the greater part of the smoke arising from the fresh coals will, in its passage through the live ones, be heated so as to be converted into flame. By this means much more heat is obtained from them, and the red coals are longer preserved from consuming. This construction, though not so complete a consumer of all the smoke as the vase, is yet fitter for common use, and very advantageous; it gives also a full sight of the fire always, a pleasing object which we have not in the other. It may with a touch be turned more or less from any one of the company that desires to have less of its heat, or pretented full to one just come out of the cold; and when the front bars of the grate are supported in a horizontal position, a tea-kettle may be boiled on them.

Notwithstanding the acknowledged advantages of Dr. Franklin’s construction of a stove, the expense and trouble of it, and the difficulty of procuring workmen who understand the manner of executing it, have prevented the general use of his stoves. Mr. James Sharp, with a view of obviating these objections and difficulties, has proposed several improvements, for which he has obtained his majesty’s patent. According to the method which he proposes, they are easily accommodated to any rooms, where communication can be had with the external air; both to those which have, and those which have not chimneys; so that not only small rooms, but the largest halls, libraries, or churches, may be warmed in a more effectual manner than had ever been done before, and the greatest degree of heat produced from a given quantity of fuel. Mr. Sharp, by adding funnels to the top, renders these stoves fit for any chimney, and by lengthening the funnel, to any place without a chimney. By the hollow base with which his stoves are furnished, he is able to apply them with much greater effect to the external air, without any addition of brickwork; and by the alterations in the air-box, a much greater quantity of warm air is introduced than it was possible to introduce in their former state. If a stove of this kind is to be placed in a common fire-place, a hole must be made through the back of the chimney, or through the hearth, to communicate with the external air; and this hole should be made as large as possible, and in a defending position, so that the outward air may ascend towards the stove. The hollow base of the stove must be placed against this hole, so as to cover it completely; and the bottom of the base must be fitted so close to the earth, and pointed with lime or putty, that the air may not pass. Upon the stove there must be put a few feet of iron funnel to reach above the breadth of the chimney; and the chimney inclosed by iron plates, so constructed and placed in a square or oblong iron frame, that they may be easily removed when the chimney wants sweeping. By this construction, the warm air, introduced by the stove, will be carried into the room, which would otherwise pass up the chimney, and be lost. But if the stove is to be fixed in a room where there is no chimney, it may be placed in any part of it, where communication may be had with the outward air; and nothing more is necessary than a sufficient length of funnel to carry it through the roof, or wall, or window, or into any other chimney that may be convenient. If the fire-place be too small for the stove, the chimney may be closed by the aforementioned frame and plates, and the stove stand before the fire-place, and the smoke be turned off, by the help of a circular elbow, into the chimney above the mantel-piece. Many of these stoves, it is said, have been lately put up, in order to cure smoky chimneys, and have always succeeded. For farther particulars, see Sharp’s Account of the Air-Stove Grates, &c.

The inhabitants of the northern parts of Europe have long been accustomed to the use of stoves in which the fire is shut up, and gives out its heat to a draught or current of air, which is made to pass through proper openings in the stove, and when sufficiently warmed, enters into the apartment. The smoke arising from the fuel is made to pass through a circuitous passage of flues, by which means the greatest part of the heat is absorbed. Stoves on this principle are known in England, but are very seldom used, except for warming of halls, staircases, and passages, in grand houses, as the English are not contented to feel the air warm, unless they see the fire. In Russia, Sweden, and other northern countries, they are indispensably necessary, as without them, it would be impossible to keep the rooms tolerably warm. A common fire-place has too large an opening, and smoke be not taken up by the wood, &c. the heat it produces is hardly sensible, because it follows the current of the air, and is carried off by the smoke. The stoves, on the contrary, retain the heat a much longer time; and as their external parts, and also their flues, are very thin, they communicate their heat very readily, so that with a small quantity of wood, they warm an apartment much more than the fire of a common fire-place would do, with six times the quantity. For it was not sufficient that the inhabitants of these severe climates should discover the most ingeneous means of keeping up in their houses a comfortable degree of heat, it was also necessary that this should be done with the least possible expense of fuel.

The stoves which they employ perfectly fulfill the above-mentioned intentions; they are also susceptible of every kind of ornament. The more surface we give to a stove constructed in this manner, the more the heat is increased, consequently we must not be surprised to find that this kind of stove sometimes occupies the whole height of an apartment, its width and depth being proportioned to its height.

The construction of these stoves is simple; they consist of four,
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four, five, or more small chambers, built one above another: the lower one is for the fire which burns in it, and the smoke rising from it enters into the chamber immediately above, then into the third, and from that to the fourth. The passageways through which the smoke enters into one chamber from that beneath, are, in all cases, made at the corner of the chamber, opposite to the passage at which the smoke will pass out from the same chamber to the next above it. By this means the smoke is obliged to pass through the whole of the chamber, and has the greatest chance of transmitting its heat. A fire lighted in one of these boxes early in the morning, and with a small quantity of fuel, will retain a strong heat during the whole day. The door of the fire-place is only opened to put in wood, and remains afterwards constantly shut. The wood lies upon a grate, consequently it is not buried in and stifled by the ashes. The ash-hole is spacious, and one or two feet in height, according to the capacity of the stove. Two doors are placed at the extremities of the ash-hole, and the current of air is very considerable, by which the smoke is carried up with great force, and the wood burns very briskly.

Stoves of this kind may be advantageously placed in halls, at the bottom of staircases, and in the anti-chambers of great houses: they may also, by proportioning their size to that of the rooms for which they are intended, be made use of in the housetops of private persons. To this it may perhaps be objected, that the heat produced from these stoves is unwholesome, because they deprive the air of its moisture; and that the air, by being made too dry, loses its elasticity, in consequence of which, respiration becomes difficult and laborious. These objections would appear of greater weight, if we had not the example of the Kuffians, the Swedes, the Danes, the Germans, and in short all the inhabitants of the north of Europe, to show that those who are habituated to such stoves, do not find them unwholesome. If others should be sensible of inconveniences from the dryness of the air in the apartment, it may be easily removed by the very simple expedient of placing upon the stove a vessel of glass or earthen-ware, which has a large surface, and is very shallow: this being filled with water, will indefinably evaporate, and restore to the air the moisture of which the heat of the stove has deprived it: the air will then recover its elasticity. If orange-trees are exposed to the heat of such a stove, and the fire is not properly regulated, the plants grow yellow and lose their leaves, especially if the air is not changed, which in winter is not very conveniently done; but if a vessel of water be placed upon the stove, the evaporation of the water will preserve the trees.

In a memoir published by M. Guyton in the Annales de Chimie, he has explained the construction of the stoves employed in Sweden, and recommends the adoption of one constructed on the same principle for general use in France.

The memoire is translated in the Repertory of Arts, 1st Series, vol. xvi. The construction of the stove which is there recommended may be improved, to adapt it to our use in England, where pit-coal is used: but the following principles, which the author lays down, are very useful as guides in making all kinds of stoves for warming apartments.

1. Heat is produced only in proportion to the volume of air confused by the fuel.

2. The quantity of heat produced is greatest, (the quantity and quality of the fuel being the same,) when the combustion is complete.

3. The combustion is the more complete, in proportion as the fulineous part is longer retained in channels where it may undergo a second combustion.

4. The only useful heat is that sent out into, and retained in the space intended to be heated. The temperature of that space will be higher in proportion, as the current which must be renewed from without to support the combustion, is less enabled to take up its passage the heat produced.

Hence the following inferences evidently arise:

1. The fire-place ought to be insulated from all bodies that are rapid conductors of heat. All the heat that goes out of the apartment is usefully lost, unless intentionally directed into another apartment.

2. Heat being produced only by combustion, and combustion being sustained only by a current of air, the current should be brought in by channels, where the needful rapidity may be preferred without being too distant from the space to be warmed, so that the heat it there departs, may be gradually accumulated in the whole of the insulated furnace, in order afterwards to flow out of it slowly, according to the laws of the equilibrium of that fluid.

3. The wood being far consumed as to give no more smoke, it is advantageous to close the mouth of these channels, in order to retain there the heat that would otherwise be carried off through the upper flue, by the continuance of a current of fresh air, necessarily of a low temperature.

4. Lastly, it follows from these maxims, that all things being equal, a higher temperature will be obtained, and supported during a much longer time, by forming, in the internal parts of the stove, or under the hearth of a chimney, and in their vicinity, tubes in which the air coming from without may be warmed before it enters the apartment, to serve the purpose of combustion, or replace that which has been consumed. These have been called bouche de chaleur (mouths or apertures of heat); because, instead of contemplating their principal use and intention, it is commonly imagined that they are only made in order to give by their issue a more rapid current to the heat produced. Nor is this idea absolutely devoid of foundation, since the air that issues from them has only changed its temperature, by carrying off a portion of the heat that would have remained in the interior. Thence, however, who would propose the mouth to the most important object, which is the retaining of the heat as long as possible, do not consider that they may be closed, and all communication with the external air cut off by a simple slide, and, therefore, it is easy to derive from them every possible advantage without any inconvenience. And we may add, that in small apartments, or such as are accurately closed, they are often indispensably requisite, if we could avoid being exposed to currents of cold air. Dr. Franklin very justly quotes a Chinesse proverb to this effect: "Shun a current of air, it's a narrow passage as you would the point of an arrow."

The Swedish or Russian stoves, which have chambers for the reception of the flame and smoke, are little known in this country: but stoves which are in common use in the halls and vestibules of our great houses are French stoves. They differ from the others in having a very great length of small flues or winding passages, through which the smoke passes, and communicates its heat to the air, which circulates in similar passages, until it becomes warmed, and makes its exit through the mouths into the apartment. This method is not so simple as the small chambers or apartments of the Russian stoves, nor is it so good in the long run; because the passages are very liable to become clogged with soot:
and even before they are so clogged as to intercept the passage of the smoke, the transmission of the heat is much impaired, because the interior surfaces of the flues becoming coated with soot, do not conduct the heat so rapidly, and in consequence, a great part will still pass out into the chimney. Also, these flues with small passages require a stronger draught in the chimney, to make the air pass through the passages, than when chambers are used.

The Holland stove, which has a flue proceeding from the top, the fire-place and ash-pit being closed by small iron doors opening into the room, comes next to be considered. It is frequently made of iron-plate, and is most commonly called a German flue. Its conveniences are, that it makes a room warm all over, for the chimney being wholly closed, except the flue of the flue, very little air is required to supply that, and therefore not much rushes in at crevices, or at the door when it is opened. Little fuel serves, the heat being nearly all fared; for it radiates almost equally from the four sides, and the bottom and top, into the room, and preferably warms the air around it, which being rarefied rises to the ceiling, and its place is supplied by the lower air of the room, which flows gradually towards the flue, and is therefore warmed and rises in its turn, so that there is a continual circulation, till all the air in the room is warmed. The air, too, is gradually changed by the flue-doors being in the room, through which part of it is continually paffing, and that makes these flues more wholesome, or at least more pleasant, than the German flues, next to be spoken of. But they have the inconvenience that there is no fight of the fire, which is in itself a pleasant thing, nor can any other use be conveniently made of the fire but that of warming the room.

When the room is warm, people not seeing the fire are apt to forget supplying it with fuel till it is almost out, then growing cold, a great deal of wood is put in, which soon makes it too hot. The changes of air are not carried on quick enough, so that if any smoke or ill smell happen in the room, it remains a long time before it is discharged. For these reasons, the Holland flues have not been much introduced among the English (who love the sight of the fire), used in workshops, where people are obliged to sit near the windows for light, and in such places they have been found of great use.

The real German flue is made like a box, one side wanting, and that side is built against the wall of the room. It is composed of five iron-plates screwed together, and fixed so as that the fuel can be put into it from another room, or from the outside of the house. It is a kind of oven reversed, its mouth being without and body within the room that is to be warmed by it. This invention certainly warms a room very speedily and thoroughly with little fuel: no quantity of cold air comes in at any crevice, because there is no discharge of air which it might supply, there being no passage into the flue from the room. These are its conveniences: its inconveniences are, that people have not so much fight or use of the fire as in the Holland flues, and are moreover obliged to breathe the same unchanged air continually, mixed with the breath and respiration from one another's bodies, which is very disagreeable to those who have not accustomed to it.

This may be remedied by making a small aperture into the flue, with a register to draw off the air. This kind of flue is still less in use in England than that which we have before described, and which is generally called the German flue, although it is used by the Dutch instead of the Germans.

Mr. Strutt, in their extensive cotton-mills at Belper, in Derbyshire, have employed a kind of flue which is found to answer extremely well; it consists of what is called a cockle, that is, a square chest or vessel of iron-plated, riveted together in the manner of a boiler, and let in a furnace, so that a fire can be made within itself upon a grate, and the smoke will pass off through a small passage into the flue which conducts to the chimney, the passage of which is regulated by a sliding damper. The cockle is of considerable dimensions, as much as four feet square and five feet in height, and the fire is made at the bottom of it, upon a grate of about fourteen inches by eighteen, so that the fire does not any where touch the inside of the cockle, but the heat rising up therein gives a considerable and equal heat, without rendering it so hot as to burn the air which it is intended to warm, for if that is once done the air will be rendered unpleasant.

The cockle is inclosed in a casing of brick-work, which is of the same shape as the cockle, and leaves a space all round between a few inches. This space of brick-work is again surrounded by walls of brick-work, leaving a space of about eighteen inches all round; and these walls are carried up, to form the chimney or funnel to convey the warmed air up to the several apartments of the mill. This chimney is divided, by thin brick partitions, into as many different flues as there are floors to be warmed; and a small opening is made, with a register, from each flue into the apartment it is intended to supply. This opening is made close to the floor; and in order to make a change of the air, ventilators are placed high up in the apartment, so as to be near the cockle.

This division of the chimney into several different flues is intended to equalize the supply of air to the several apartments, and by this means the upper apartments are equally well supplied with warm air as those below.

In order to make the air pass in contact with the surface of the heated cockle, a horizontal partition is built in the space between the chimney and the brick-casing of the cockle. The level of this partition is at about one half the height of the cockle, and its effect is to divide the brick-casing of the cockle into two halves, one above the partition and the other below. The cold air is freely admitted into the lower part of the chimney beneath the partition, but cannot escape into the chimney above it, without entering into the space between the cockle and its brick-casing, through a number of small openings made in it beneath the horizontal partition; and in thus passing in contact with the surface of the cockle the air becomes heated, and passes out again, through openings in the brick-casing, into the chimney above the partition. In order to make the cold air strike more forcibly against the heated surface of the cockle, a small iron tube is fitted through each of the openings in the lower part of the casing, and the ends of these tubes approach very near to the surface of the cockle. Mr. Strutt has introduced this kind of flue into the new Infirmary at Derby, and in several other similar institutions it has been adopted with great success.

In 1799, Mr. James Burns of Glasgow took out a patent for an improved flue, or fire-grate, to burn with an open fire: his flue has a very elegant appearance, and several advantages. The object of the improvement was to prevent the heat generated by combustion, and thrown out into the apartment by radiation, from being unnecessarily wasted by the draught of air for the support of the fire, as is usual in flues or grates of the common construction; where all the air that goes to maintain the combustion is furnished from the warm air in the room, the waste of which is supplied by the exterior cold air, which comes pouring into the room at the bottoms
STOVE.

bottoms of the doors, or by the sides of the windows, and thereby undone a great part of the effect that otherwise would be produced by the fire. To accomplish this intention, the air that maintains the fire in the improved stoves is brought through a tube, which is called the air-tube, from the outside of the house, and may be made to pass between two of the joists, (where the floors and ceilings are close enough to allow this,) so as to be brought to the bottom bars of the grate, without having any communication with the interior air of the room; while, at the same time, the grate and parts connected with it are so constructed, that when the fire is not wished to be supplied with cold air from the outside of the house, the passage may be shut more or less perfectly by means of a valve, a small door, a cock, or any similar contrivance. When convenience does not admit of the air-tube being carried to the outside of the house, it may be carried to a cellar, larder, or store-room, and the flame end will be gained, with this further advantage, that such cellar, or other apartment, will be always well ventilated, and prevented from acquiring or retaining any unhealthy or disagreeable smell.

The principle is to supply the fire with air from without the room or apartment, so as to prevent the warm air of the room from being drawn to the fire-place and hurrying up the chimney, while, at the same time, all the advantages of open grates may be enjoyed.

The form of Mr. Burns' stove is that of a vafe or urn placed in the chimney-place, which is made circular, to form a niche for its reception. The urn is open at top, and the sides are formed of open work or grating, with a grated bottom, forming a sufficient space to contain the fire; but the pedestal and lower part of the vafe are made close, to prevent the entrance of air to the fire, except that which passes up from the air-tube through the hollow pedetal; and within this pedetal is an air-valve, which opens and shuts by a register, to regulate the entrance of the current from the open air. In the pedetal of the vafe is a drawer, to receive the ashes. The niche or chimney in which the vafe is placed, has the usual opening at the top, to cause a draft to the face of the furnace. The air for the support of the fire enters from the external air, through the tube or air-pipe before described, and passes into the hollow pedetal of the vafe; and having passed through the hollow neck or stem of the vafe, it finds no difficulty in passing up through the bottom of the grate, the back or side of the ash-drawer next which the aperture is being made low, to allow it to flow in freely. The grate and its internal cavity may be of any convenient form, but circular or elliptical will answer best, especially when another improvement is applied. This is a glass door or iron-work fence or screen, to prevent those dreadful accidents which so frequently occur in ladies' or children's clothes being set on fire by sparks from the grate. Where this safe-guard fence or screen is wished to be applied, the jaspe of the chimney where the grate is to stand must be a semi-cylinder, or nearly so, with a lining or cover, made of metal, at such a distance from the semi-cylindrical wall or niche in which the vafe is placed, as to give sufficient room for allowing the safe-guard or fence to be slid round into it, when the fire is wished to be left open to introduce freer fuel, or when the drawer with the ashes is to be removed. The fence is a frame-work of metal, which, when filled up with glass, or with wire-work, forms a portion of a cylinder, answerable to the curvature of the space between the back of the chimney and the lining above-mentioned, made in one or two pieces, and moving in a circular groove in the hearth, which serves to conduct it into its place behind the grate, when the fire-place is wanted to be left open, as before-mentioned. The top of the front of the opening (the chimney-piece) projects in a circular form, or is furnished with an added projection, made of metal, and furnished with a circular groove on its under surface, of the same radius as the groove in the hearth, for the purpose of guiding the upper part of the frame of the guard. The glass with which the frame of the guard is filled may be stained or painted; complete safety is obtained, and, at the same time, the comfort arising from the view of a cheerful fire is not prevented by the interposition of any opaque body. But for nurseries or the like, where convenience and safety are more the objects than elegance or luxury, the frame-work may be filled up with wire-work.

Instead of such grooves at top and bottom for the fence to move in, the fence itself may be furnished with a groove at its top and one at its bottom, to receive any projecting piece of metal, or other substance of proper curvature; or its bottom groove may receive the upper edge of the fender, which, being made to a proper curve, and properly adjusted and kept in its place, will answer the same end. But whichever of these ways be followed, or whatever other method of construction (for it may easily be varied to answer circumstances), rollers or castors should be provided at the lower part of the fence, to make it move with greater ease, either to the front of the grate, or into the space between the back of the chimney and the lining above-mentioned.

Where either the glass or the wire-work frame, or both of them, are meant to be applied to figures or rectangular chimneys, without the trouble of giving them a semi-cylindrical form, the lining to receive the fence or fences may be introduced at the sides, or jambs, of such chimneys; or the fence may be made to slide, by means of pulleys, into the wall above the opening, or be slid sideways into the walls at the sides of the openings.

Besides the advantages already pointed out as connected with them, these stoves possess also the following; any room or apartment may be heated by their means with a much smaller quantity of fuel than by common open fires; at the same time, the advantage of seeing the fire is not lost, the whole being visible through the front of the grate, for these grates have side as well as bottom bars, which allow the radiant heat and light to be thrown out into the room, without any impediment; and, in fact, large rooms, halls, and the like, which by the usual methods can hardly be warmed, or made at all comfortable in cold weather, may, by means of these improvements, be heated as effectually as the smallest apartment; for when their full effect is wanted to be procured, it is only necessary to keep the fence in its rears, that even that portion of heat which would be kept back by the interposed glass or wire-work, may be thrown out into the room, and perform its office.

In 1804, Mr. Josiah Jowett of London obtained a patent for a very similar contrivance, which he called a fire-guard stove, which is intended to prevent accidents from sparks of fire flying out. The stove itself is an open fire, and is usually made of a cylindrical form, the axis of the cylinder being vertical. One half of the cylinder which faces the apartment is made with bars at the lower part, to contain the fire, and an opening over them to feed it. The back part of the cylinder is made of cast-iron plate; but, instead of the brick-work being built up close round the back, a small space is left to receive the guard. The weight of the stove or grate is supported upon a vertical iron bar, which is in the centre, or axis of the cylinder, which forms the stove, and the guard swings round upon this bar as a centre, and being a half-cylinder of wire-work, can be brought in front to insulate the
The fire-guard may be fixed to any stove which will admit of two centres or pivots being placed in a perpendicular line in the back of the stove, to support the fire-guard, and guide its motion; and the stove must admit of grooves on either side, for the guard to pass through, as the levers will direct. The principle of the action of the fire-guard, is that of being united to two centres or pivots, placed perpendicular one to the other; and it is connected to the two centres fixed to the stove by means of two lever-cranks, one end of which is fixed to the guard, and the other end of each to the centres or pivots, by which the guard swings in a rotary motion, passing through a groove formed in the stove on either side, to swing before the fire when required, and is brought into use by means of a handle or knob, fastened to the front edge of the frame of the guard for that purpose; or, instead of drawing it out with the hand, as before described, it may be brought into use by means of a spring fastened to the crank, and pressing against the cheek or back of the stove, to throw the guard forward. The same effect may be produced by means of a balance fastened to any part of the fire-guard, and working with a line or chain over pulleys fixed to the stove, or by means of the combined force of the spring and balance.

Mr. Allan Pollock took out a patent, in 1807, for a stove which is very similar to the Swedish stoves, having chambers through which the smoke is successively conveyed, and gives out its heat to the air of the apartment in which it is placed; in addition to this, the stove is made to give a constant current of warm air; for this purpose, the cold air is made to enter and circulate through winding passages, situated in the back of the fire-grate, or space in which the fire burns, and the frame passage is continued, by an iron tube, through the smoke-chambers up to an air-chamber situated in the top, from which it passes into the apartment. These stoves are made of cast-iron; but, to prevent the air receiving any taint from passing in contact with the hot iron, Mr. Pollock supplies a small addition to the smoke-moulds, in which the pipes are to be cast, which composition will become vitrified by the heat of the melted iron, when the frame is fused into the mould, and will form a glassy or vitrified lining to the tubes, and prevent the actual contact of the air with the iron. These stoves answer very well.

A very important improvement is those fire-places for burning of coal, which are generally called register-stoves, has been lately made by Mr. John Cutler of London, for which he had a patent in 1815. The stoves constructed by him are nearly such as are known by the name of register-stoves, being made of cast-iron plate to incline the fire-place at the back and sides, but open in front to the apartment; leaving only a passage for the smoke through a regifter, at the upper part of the inclosed space. Mr. Cutler's improvement consists in applying to such grates or stoves a chamber, or magazine, situated beneath the grate (or the space inclosed by grating) in which the fire is to burn. This chamber is to contain a magazine of fuel sufficient to supply the combustion for a whole day, or other required space of time; the bottom plate of the chamber is moveable; and by means of a wheel and axles, the fuel contained in the magazine can be elevated, so as to introduce a portion of the fuel into the grate at the lower part, or from beneath; and thus, from time to time, replace the fuel which is consumed, without the trouble of occasionally throwing on coals.

In order to make the fire burn, the flue or entrance to the chimney must be of such a construction, as will produce the most efficient draught or current of air to pass through and across the top of the fire. This improvement of introducing a supply of fuel into the grate from beneath, causes the fire to burn clear and with little smoke; because the smoke, or gas, which issues from the newly introduced fuel, when it is first heated, must of necessity ascend through the hot ashes of the fire, and be wholly consumed. Another improvement is to reduce the fire, or extinguish it, when it is left for the night. This is done by lowering down the whole of the fire from the grate into the chamber, or magazine, beneath the grate: the supply of air is thus interrupted, and the fire is completely inclosed in a deep chest, so that it is impossible sparks can fly out, and the fire soon becomes extinguished. The advantages of these improvements are by no means trifling. By burning the smoke, the whole effect of the fuel consumed is produced, and were this invention universally introduced into London, that pernicious foetid atmosphere in which it is hidden would be to improved, as to be equally pure with that of Paris, or other continental cities, where wood alone is used for fuel.

The burning of the smoke renders the sweeping of the chimneys unnecessary, and the danger of fire from the foot contained in the flue is avoided: also chimneys which throw out smoke into the room will, in almost all cases, be cured by this improvement, because the quantity of air or gas which must pass through the chimney is so small. To avoid the trouble of throwing on coal, and to have at all times a bright and cheerful fire, are matters of convenience, but are not wholly to be overlooked; and, lastly, to have the means of extinguishing the fire, when it is left for the night, is a most important improvement; when it is considered that, amongst the fires which happen every year in London, how many break out in the hours when the fires are left, and a great proportion are doubtless occasioned by fires left unextinguished.

The machinery for raising up the moveable bottom of Mr. Cutler's stove is very simple. The magazine-chamber is composed of iron plates joined together, and the moveable bottom is fitted to it, so as to leave as small a space round the edges as possible. A bar is fixed across beneath the bottom plate, and the ends of this bar pass through slits, or narrow openings, in the side plates of the chamber. To the extremities of the bar the ends of two chains are attached, and the upper ends of these chains are made to wind upon the ends of a horizontal axle, which extends over the top of the stove, so as to be within the chimney, and out of sight. The axle is turned round by a face or crown-wheel, fixed upon the extremity of it, and the teeth thereof are engaged by the teeth of a small pinion, the axis of which comes through the iron work of the stove; and the end has a small square hole in it, to receive a square or key upon a small winch handle. By means of this handle, the iron axle is turned round, and winds up the chains, so as to elevate the bottom plate of the magazine, and thereby raise up a portion of fresh fuel into the lower part of the grate, where it is burned, as before mentioned; and the smoke which first issues from the coal rises through the fire, and is thereby consumed.

Mr. Cutler has made a great number of these stoves, which are found to answer very well; they have all the same properties as Dr. Franklin's cylindrical grate, but in a greater degree; and the fire can be supplied with fresh coals at the lower part, without the trouble of inverting the grate.

Stoves, American, are contrivances for warming of rooms.
by a continual introduction and exchange of dry fresh air. These stove are elevated American, because the first patterns in cast-iron upon this principle were the invention of Dr. Franklin, who then resided in Philadelphia. See Fire-Places.

Stoves, Chinese. See Kang.

Stoves, Dutch and German. See Fire-Places.

Stoves, in Gardening, a sort of garden-building or erection, coming down, brick and won in the north, as well as partly in the east, and roofed wholly with glazed flues to the south; being furnished internally with a pit, or long, wide, deep cavity, for a hot-bath or beds, and with flues round the inside of the walls for fire-heat: the whole calculated to produce a certain temperature at all seasons, adapted to the culture of the tenderest exotic plants, as well as for forcing various kinds, both hardy and tender, into flower and fruit, &c. at an early season; and which was so named before the use of bark-beds, from being worked only by means of fire-heat.

By their means the gardener is enabled to forward many hardy plants to early perfection, such as various sorts of curious flowers, fruits, fallad-herbs, dwarf kidney-beans, strawberries, &c.; and likewise many sorts of seeds, cuttings, and layers of exotics are made to grow freely in the bark-bed of the stove, that without such aid would not grow at all in this country.

There are different sorts of stoves used occasionally for different purposes: as the bark-beds, for common use, which has both a bark-bed and flues; the dry-beds, for particular succulent plants, &c.; which is furnished only with flues for fire-heat, having no bark-bed; the forcing-beds, which is employed purposely for forcing hardy fruits, flowers, &c. into early perfection, being constructed both with bark-bed and flues, or only with flues. By the uniform, moderate, moist, growing heat in the first fort of stove, many kinds of such plants as have been mentioned are brought forward and preferred, and in which some require the bark-bed, others succeed in any part of the house; and still others, as the succulents, require the driest situation near the flues. Many of the more tender herbaceous and shrubby plants, (such as fuchsia) are plunged in the bark-bed, though the greater part of the herbaceous and woody sorts succeed well enough in any part. The bark-bed is principally allotted for the pine-apples; and most of the smaller succulents, particularly may be flattened mostly over the top of the flues upon shelves, out of the way of moisture, as being naturally very replete with humidity; and the hardy plants designed for forcing, such as strawberries, kidney-beans, and various sorts of flowers, &c. that are potted, may be placed upon shelves, or on the parapet wall of the bark-bed; but the nearer the glass the better, particularly strawberries: but good early kidney-beans may be raised in almost any part of the stove. When any sort of flowers are to be forwarded, such as roses, pinks, &c. or any bulbous flowers, as early as possible, they may be plunged in the bark-bed, and some be placed upon shelves, &c. to succeed them. This sort of stove is sometimes called the moist stove.

The second sort of stove, from its affording a dry heat, is intended principally for the culture of very succulent tender exotics of parched soils, that require to be kept always dry. Where there are large collections of this sort of plants, it is very useful to deposit the most succulent of them in separate stoves, for fear of the others, which perish more freely, occupying a damp air in winter, which may be imbibed by the succulents, and injure them, as being impatient of much moisture, particularly in that season. In this kind of stove, moveable flans or shelves are erected above one another, on which to place the pots of plants, such as the tenderer sorts of aloes, cereus, euphorbiuns, melon-thistle, and other very tender succulent plants, &c.; but most of them may be cultivated in a common stove, with proper care.

The third sort of stove is sometimes used principally for flowers, as is common about London, to force large quantities of early roses, pinks, and numerous other flowers for any curious tender annual flowers, such as bellflowers, &c. and for fruits both for forcing flowers and fruits, and several sorts of small plants, as strawberries, kidney-beans, &c.: so that they confite of two kinds, which are a bark forcing-stove, furnished with a bark-bed and flues; and a fire forcing-stove, having only flues for fire, without any bark-bed: the former of which is constructed like a common bark-stove, being furnished with a pit for a bark-bed to receive the pots of particular sorts of plants intended for forcing, in order to forward them as being possible; and with flues for fire-heat occasionally, and sometimes it is formed capacious enough to admit of a border of earth behind the bark-bed, next the back wall, serving for fruit-trees to be planted in the full ground, such as cherries, peaches, apricots, &c. for early forcing. The bark-bed is for receiving various sorts of plants in pots in winter, for forcing to maturity of growth or production in that season, or early in the spring, as pots of roces, pinks, dwarf tulips, hyacinths, narcissiules, honeyfuckles, hypercums, and many other flower-plants of small or moderate growth, both of the shrubby and herbaceous kinds; also any curious tender annual flowers, such as bellflowers, &c. may be forwarded in it; likewise pots of strawberries, dwarf cherries, and other small fruits, plunged either in the bark-bed, or placed anywhere towards the glassies; also pots or boxes of kidney-beans, fallading, &c.

But besides these large stoves, it is necessary to have what are called succession stoves, and small pits for striking, forwarding, and nurting the plants in, while they are in their infant state of growth, especially where the collections of them are large, in order to prevent the large stoves from being usefully filled with plants of productive nature, and for the purpose of greater convenience. The pits serving to strike the plants in, and the succession stoves for placing and continuing them in afterwards, until they become ready and fit for fruiting or setting into the large stoves.

Stoves are constructed in various ways, and of many different sizes and forms, so as to suit the forts of culture and management that are to be carried on in them; but the most generally useful dimensions for them are probably those of from about ten to twelve, or fifteen feet in height behind, with any fittable length, and eight, ten, twelve, or more in width, having from two or three to five or six feet of height in the front. Very lofty or capacious stoves are but rarely wanted.

The most economical form of stove, Mr. Loudon supposes, is that of a parallelogram, placed from east to west, of glass on the south side, roof, and ends; and masonry toward the north: but that the most elegant and eligible for the plants, is one placed north and south, and of glass on all sides; however, unless an inner roofing be used in this case, glass on all sides is precarious, especially in the northern parts of the island. Stoves of the dry kind are kept at a temperature, in general, between fifty-five and seventy degrees of Fahrenheit's scale, and moit stoves between sixty-five and ninety degrees of the same thermometer. Where the plants are grown in pots, and plunged in earth.
earth or bark; the pits should be made of considerable depth, to admit of the materials, as in the usual culture of the pine; but pits filled with earth, and managed in the manner proposed by the above writer for growing this sort of plants, is so decidedly preferable, both in respect to beauty and economy, that few, who well understand the plan and think for themselves, will reject it for flower-plants, though they should even think it unfit for raising or growing those of the pine kind. See Bromelia.

The different modes of constructing houses of this kind are now so well understood, that they need not be noticed in this place, especially as they have, in some measure, been pointed out under the culture of the feveral plants which are raised or managed in them, and under some other heads. Before, most of the late improvements in the flowers of them, which are the most material parts, will be seen below.

Theucculceon stones and pits are probably the belt and most conveniently arranged and formed, either in connection with or contiguous to the large flowers, so as to admit of the plants being readily removed into them. They may be made of different sizes, in proportion to those of the flowers, and be provided with flaring glases in different ways, according to circumstances, but mostly in the manner of the principal flowers, especially in the former.

The flower-plants which are raised in flower-plants should be of any large dimensions, but have axes somewhat proportionate to those of the flower-plants, having flowers and glases, for the most part, only upon the top parts of them.

The fewon to begin forcing in these flowers is principally from about the latter end of December to the end of January, according as the flowers, fruits, &c. may be wanted: the plants and trees intended for forcing in pots should have been potted either a year before, or in the preceding spring or autumn, and in winter sheltered from severe frost till the forcing time: it is necessary for the shrubs and tree-kins in particular, as if planted or potted the preceding year, or before, and they are well rooted and firmly established in the earth, it is of essential advantage; being all previously raised in the open ground, till advanced to proper growth for flowering and fruiting; and the fruit-trees at the same time, trained in the requisite order: those intended for planting in the internal border of earth behind, should be planted fully therein early in autumn, without being potted; some of which, such as peaches, nectarines, apricots, &c. being trained as wall-trees, others as low standards, particularly cherries; and vines, planted also against the front without, have the stems trained in through small holes, and conducted up under the flaring glases: but such plants as are to be raised from seed, should not generally be sown till the time the pots are placed in the flower for forcing. When the plants, seeds, &c. have been properly arranged in these flowers, they are soon set in motion by the bark-bed heat, and afterwards by making moderate fires on cold nights, and on days occasionally, in very severe weather, to support a constant proper warmth to continue the plants always in moderate growth; by which means, various flowers and fruits may be obtained two or three months before their natural season in the open air.

But those of the latter kind, or such flowers as are worked by fire-best only, are mostly used for forcing fruit-trees, having the whole or most part of the bottom space within formed of good rich earth, full two feet deep, in order to plant the fruit-trees entirely in the ground to remain; an alley or walk being either formed next the back wall, or carried along the middle, allowing a raised border along the back part for the reception of the chooser fruits to be trained as wall-trees; and the main middle space for small stands of moderate growth: in these, the belt forts of apricots, peaches, nectarines, cherries, plums, vines, and figs; likewise any small fruit-plants, as gooseberries, currants, raspberries; also tufts of strawberries, which should all be first trained in the open ground to a bearing state; may be introduced: the peaches, nectarines, apricots, and figs, should be planted principally toward the back wall, and trained to a trellis, as wall-trees: the cherries as standards, both small-headed, moderate, full standards, half standards, and dwarfs, disposed in the middle space, the tallest behind, and the lowest forward; with pots of strawberries and low flowers upon shelves near the glases; and the vines either within, towards the front, or wholly without, close against the front wall; and the flemas, or a strong shoot of each plant, drawn in through a small hole made for each, either in the wall, or in the timber of the front ejections; and the branches within trained up to the inside of the flaring glases upon trellis-work: in the vines planted on the outside, it is necessary to guard the stems in winter, especially some time previous to and during the forcing leason, with hay-bands wrapped closely round them, also to lay some dry mulch over the roots, to protect the whole as well as possible, that the progress of the sap may not be much retarded by the external cold, and to promote its flowering more freely for the advantage of the internal growth of the vines, &c.

When the lozenge to begin forcing or making the forces in these flowers is January, or early in February, continuing it moderately every night and morning, during the cold weather in winter and spring, to forward the different fruits to as early perfection as possible.

Great improvements have lately been made in the construction of houses of this as well as other similar kinds in which fire-heat is required; and better and more effectual modes of applying it in these and other cafes and uses suggested. In a communication from C. Lorimer, esq. to the Caledonian Horticultural Society, can-dues are strongly advised in the construction of such forts of houses. The flowers of this kind there employed, were, it is said, from twenty-five to twenty-six inches long, of a conical or taper shape, from thirteen to thirteen and a half inches in diameter at the large end, and from eleven to eleven and a half inches at the small end, measured from the inside. In laying them for a flue, the small end is inflected into the large one an inch or an inch and a half, and the joinings closed and made secure with lime-plaster. At first, fire-clay was employed for this purpose, but it cracked and fell off, and let the smoke get into the house; however, since the lime-plaster has been used, the flue has been perfectly tight, and the house free from smoke. It is thought, that perhaps it might be an improvement, if the cans were made of a cylindrical or drum shape, all the length of the same diameter, so that the ends would exactly fit one another, with about the half of the thicknesses of them taken off on the outsides, for three-fourths of an inch from each, in order to hold the plaster. This would make the flue, it is supposed, look much neater and better on the outside, as the swelling at the joinings from the flue would thereby be greatly reduced; and when the flue was cleaned, the foot would be more readily and with greater facility got out, as it would be quite smooth in the inside from end to end.

It may be urged as an objection, it is said, that the houses may not have so much steam from the can-flues as from those of the old construction, but this, it is asserted, will not be found to be the case. As full as much steam has been raised by sprinkling the cans by means of a fine-rose watering-
ing-pan or pot, after they have been sufficiently heated, as could ever be done by the flues of the former construction.

In one instance, though the cans had been made of common clay, they spread the heat very well, and notwithstanding the flue once took fire; only the can next the furnace became cracked, but those made of fire-clay are thought to be safer, the strongest fire that has been applied not having in the least injured them.

In consequence of the cans not being half an inch thick, it is said, that they transmit the heat sooner, and in much greater proportion, than flues of the old construction, which are commonly three inches thick in the sides, and one in the tile-covering at the top.

In laying the can-flues, the ends of them should rest upon a brick set on edge, which keeps the under sides or parts of them five inches from the ground, and of course none of the heat is drawn off or lost in that way.

It may be objected also, that it is said, to the can-flues, that they will cool sooner than the brick and tile ones; but so long as any fire remains in the furnace, the can-flues will transmit the heat, which is not the case with the old form of flues, when the fire becomes weak.

The invention of these flues is said to belong to Mr. Burnet, of Viewfield, near Dunbar, in Scotland, who some time since built a house for forcing vines thirty-five feet in length by thirteen feet in width, measuring in the inside, with one furnace, which is found fully sufficient to keep up a proper temperature in the coldest weather. This plan of flue was had recourse to in it with complete success, as he has since had the largest crops of grapes that have been there known upon vines of such an age as lately, indeed, every part of the house, from the bottom to the top, has, it is said, been loaded with a profusion of fine clusters, so thick, that they appeared everywhere almost touching each other. It has been found, that after the eyes of the grape-vines in this house are all fairly broken in the spring, and the gardener is at liberty to increase the heat in the house, the thermometer at eight or nine o'clock in the evening, commonly stands at from seventy-two to seventy-five degrees. The fire is then mended for the night; and the succeeding morning, about six o'clock, the thermometer has kept up within two or at most three degrees of what it was the night before.

The furnace in the house is built on the plan of the late Mr. Nicol, with Rumford doors; and when the fire is mended for the night, the ash-pit door is shut quite close, which prevents the heat being too much increased, and occasions a very small consumption of fuel; yet from the cans being so thin a proper degree of heat is transmitted, so as to forward the growth of the vines almost invariably.

In two small houses of this fort for vines, which have one of Mr. Nicol's or Mr. Loudon's furnaces to each, one of which has the flue built with bricks, and tile covers in the old method; but in the other the flue was some time since taken down, and a can-flue put in its place, which is considered to be a real improvement. In the former of these houses, a fire was put on the 14th of February, while in the latter there was no fire until the 30th of March following, yet the house with the can-flues ripened the grapes sooner than the other which commenced the fire about six weeks earlier, and with a considerable saving in fuel. In other trials since the above the result has been the same.

And the can-flues have been found equally advantageous in producing large crops of grapes in other instances, and capable of being beneficially employed for different other forms of fruit-trees that are forced in houses of this kind.

The superiority in the use of these earthen-ware tubes, in the place of those which are formed by stones, bricks, or tiles, is, it is said, very great indeed. On the best authority, they are stated to have been attended with remarkable success. Great crops, not only on those forts of vines which are considered the best bearers, but on those which are less productive, such as the Frontiniac, have been afforded by means of them in many different climates and situations; in all of which, the grapes were not only fine, but as well-taisted as those in any foreign climate or country; and, it is thought, that they promise not only to be greatly successful in this fort of culture, but also in that of the peach and nectarine. In short, two very great advantages may, it is supposed, be derived from the use of these flues; first, that an equal degree of heat may be had from much less fuel; and, secondly, that the same degree of heat may be easily supported, with much greater uniformity, both during the day and night. In order to procure any heat in the air of forcing-houses, when the flues are built of brick or stone, a strong fire is required, which is very apt to give too much. But with the can-flues, a very little fire, burning very slowly, will give out a sufficient degree of heat. Upon the whole, therefore, there appears no doubt that the introduction of can-flues into the forcing culture in houses of this kind, may be considered as a very important improvement in the horticultural art.

The can-flues which are thus used are capable of being easily made by any potter; for which, however, fire-clay instead of common should be employed, as having some advantages, which have been already seen.

A more improved and economical mode of constructing houses of these forts, has also lately been suggested, and communicated to the same society, by Sir G. S. Mackenzie, as the result of careful experiment. Sir George having often been surprised at the cold of houses of this nature, the most moderate of which seemed to him to put the innocent luxuries afforded by them out of the reach of persons of moderate fortunes, he resolved to attempt to erect one that should combine the least possible expense, with the means of raising more fruit in a given space than was done by any of the plans which are in common use. This bold attempt, considering the small number of plans for the purposes which are in use, or which have been proposed at different times, may be suppos- ed to be more difficult, and possibly impracticable. It has, however, it is said, been accomplished, and attended with such success, that the inventor is inclined to flatter himself it will be the means of enabling many persons to enjoy the productions of such houses who never thought of possessing them, and of adding so much to the produce of market-gardens, as to increase the quantity of the richer fruits brought to towns, and consequently to lower the prices, as this plan of training may be applied to such houses as have been already built.

The first matter that occurred to him as an object in which economy might be exercised, was the ends of such houses being constructed with glasses. He could see no reason or necessity for this; and it appeared plain, that a solid end of masonry, with a porch and double door, would be more effectual in preventing the escape of heated air, or the rushing in of cold, than a glass end and a glass door. The next object which he had in view in this intention, and for which he defined a remedy, was the frequent occurrence of breakage, during the movement of the furnace in giving air; and he conceived it possible to have them always fixed, and yet to have ample means of ventilating the house. It was likewise considered, that such expensive workmanship might thus be avoided. These are matters of some importance in the business; but the principal improvement is conceived to be, the method of training the plants in the house.
STOVE.

This and some other purpoises are effected in the following methods. The training is done by means of a frame-work, which is set up at the distances of six feet across the house, and the moving of the frames, the ventilation, and regulation of the heat, by the roof being covered with a composition, in which there are hatches fixed that may be opened by cords and pulleys, or by levers, and which shut by their own weight. The number of these hatches is, of course, to be regulated by the sizes of the houses, and the degree of ventilation which may be required. In the front, there are fah-frams made to slide part each other; so that in each division, about eight square feet may be opened. When the front is opened, and the hatches raised, a current of air instantly passes through, which may be regulated at pleasure; while all motion of the great front fasbes is avoided, and, of course, all risk of breakage from that cause prevented.

A trellis is formed on the crofs frame-work, on which the branches of the vines, peaches, nectarines, or other fruit-trees are trained. There are two trellises on each frame; and where vines are cultivated, they are planted two in each division, and one at every six feet on the back wall, in which such houses are fifteen feet high in that part, and two feet in height in the front part. Each vine in the division is trained to its respective trellis, and to half of the back wall of the building; the foil of the door; such flues being consequently not only much larger than is common even in these cases, but having the division-walls for supporting a pavement-floor over the flues, all made of open brick-work, the whole space, as above, was hereby converted into one large flue, or chamber for heated air, which being made to in Fus from the joints left in the stone-floor, circulates freely to every part of the house; so that with one common fire, the temperature of it, the area of which is 30 feet by 18, and 7 feet in height from the floor on which the flues rest, is kept inviolately from 700 to 900 of the Fahrenheit's scale, while the wet materials are hanging in it, and the shutters in the upper part are open. This effect, which is much greater than in other cases of smaller flues, is, it is said, entirely to be ascribed to the largeness of the flues. On these grounds it is conceived, that the simple application of such large flues as the circumstances of houses and other houses of that kind will admit, would not only be attended with great advantage of point of economy, as a very small fire would be sufficient to maintain the temperature usually required in such houses; and that, it is perhaps, in consequence, such flues properly constructed upon this principle are capable of being easily regulated, and will induce a much more uniform degree of heat. It would seem from the above trial, it is said, that the flues in general use are of too small dimensions; that there is not capacity in them for allowing the heated particles of air to expand; and that the heat passes through the narrow flues, and makes its escape with the smoke in a latent state, without being allowed to act upon a surface large enough to rob it of its caloric.

Upon this principle, large buildings and halls might, it is thought, be heated; and one fire might be made to heat a much greater range of vineyards, or other houses of the same kind, than is the practice at present. It would also be a great improvement in the construction of heated houses, and the inclining of gardens, where they are of the wall kind, to make the walls hollow, as well on account of such a mode of construction including a space for air, which is an excellent non-conductor, as of the facility with which the fire may be applied, by converting the whole, or the greatest part of the wall, into a flue or receptacle for heated air. When this is to be done, the fire-place should be kept as low as possible; and after answering its purpoise
the house, the flue might be made to communicate with
the hollow garden-wall, and the smoke made to escape
at a chimney situated, according to circumstances, at
a greater or less distance from the heated house. It is thought
that an apartment heated with flues of a large confruc-
tion, is less incident to sudden changes of temperature than
when the flues are small. The heat in large flues can be
regulated with much precision, and they are attended with
the advantage of seldom or never requiring to be cleaned.
In all chimneys for houses of this kind, an aperture should,
it is said, be made in the wall, with a close shutter, near the
top of such chimneys, where a lamp or lighted candle should
be introduced for an hour or two, immediately after the fire
is put on, in order to create a current, and thereby bring the
smoke to flue at the chimneys.

These constitute the most material hints and improvements
which have yet been thought of for bettering the construc-
tion of houfes of the stone and other similar kinds.

Stove Plants, in Gardening, such tender exotics from
the hot parts of the world as require the aid of the stove
in order to preserve them in this climate. They are very numerous,
so that our limits will not allow our reciting them.

Stove or Lump-Salt, in Rural Economy, a term applied
to that sort of salt which is prepared by a certain heat,
as about 225°, and afterwards dried in the flues employed
in works of that kind. See Salt.

Stoves, at Sea, are square boxes made of planks, and
lined with brick, for burning charcoal in, to dry the ad-
miral's victuals.

STOVEN, in Rural Economy, a word that signifies a
spailing flout from the floor of a fallen tree.

STOUNUCK, in Geography, a township of America,
in Cumberland county, New Jersey.

STOVER, in Agriculture, a general name for the dif-
ferent kinds of fodder arising from threified grain, whether
it be straw, chaff, or the short flaws, such as ears and
rough chaffy matter, separated by the rake or riddle from
the corn in chaff, after the straw has been removed by shak-
ing from the floor. But besides these sorts of short flary
materials, it also signifies, and is applied to, the pulls and
points which are broken off in the threfing of rape crops,
and which are eaten with great greediness as food by dif-
ferent sorts of live-rock; the pulls being often considered
as equal to hay, and the points equal to cut wheat-flour,
as fodder.

STOUTHAIN, in Geography, called by the Indians
Pokemitt, or Putipuog, i.e. taken from a spring that rifies
out of the earth, a township in Norfolk county, Massa-
husetts, incorporated in 1726, and containing 1600 acres of
land and 1134 inhabitants. It is bounded E. by Brantree,
W. by Sharon, and lies 15 miles southwardly of Bolton.
This township contains iron-ore of excellent quality, and a
rolling and flitting mill, which manufacture considerable
quantities of steel and iron. Charcoal, barks, and brooms,
in considerable quantities, are sent from hence to Bolton. In
the late war, a large quantity of excellent cannon wood was
made in this town, for the American army, from salt-petre,
the produce of the town in its vicinity.

STOVING, in Sail-making, is the heating of the bolt-
ropes, so as to make them pliable. They should be flored
in a stove by the heat of a flue, and not in a baker's oven or
a flue-tub; and tarred with the blue Stockholm tar. The
flexibility of them should be always considered in taking in
the flack, which must rest on the judgment of the sail-
maker.

STOUND, in Rural Economy, the name of a wooden
wedge to put small beer in.

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the residence of the bishops of Worcester. It was given to the diocese by Burdred, king of Mercia, and several of the bishops have strengthened and decorated it. In the reign of Charles I. it was taken and fold by the parliament, but after the restoration, it was re-edified by the succeeding bishops: it is a brick structure, with battlements, turrets, &c.—Beauties of England and Wales, vol. xv. Worcester, by Mr. Laird.

STOUSE Head, a cape on the east coast of the island of South Ronaldsay. N. lat. 58° 40'. W. long. 2° 47'.

STOW, John, in Biography, an industrious antiquarian and historian, was the son of a merchant-taylor in London, and born about the year 1525. About the year 1560 he composed the annals of the English history, and to this object he sacrificed his trade and domestic concerns; travelling on foot to several cathedrals and other public establishments, in order to examine records, charters, and ancient documents. He also purchased, as far as he was able, old books, manuscripts, parchments, &c. of which he published a number of valuable works. But being dispossessed of many of his books, he was obliged to inter his studies, and to renew his application to business with a property that had been much lessened. Benefactions, however, from Dr. Parker, archbishop of Canterbury, enabled him to prosecute his studies; but being suspected of an attachment to popery, he was banished from the city for several years, and as having possession of many pious books of superstition. His study was searched by order of Dr. Griesal, bishop of London, and many pamphlets were found in it, which discovery fixed upon his character the reproach of a suspected person; and two years after, an unnatural brother, who, having defrauded him of his goods, was a defounder of taking away his life, preferred against him above 140 articles before the ecclesiastical commission. But the infamous character of the witnesses who were engaged to prove the charges, caused him to be acquitted. His first work, undertaken at the request of the powerful favourite, Robert Dudley, earl of Leicester, had been already published; and as it had been dedicated to the said nobleman, his countenance was of service to him in his prefixed circumstances. This was "A Summarie of English Chronicles," first printed in 1565, and several times reprinted. This book contained an account of every English king from the era of the fabulous Brutus, down to his own time, with a list of all the principal magistrates of London from the Conquest. It was afterwards continued by Edmond Howes, who printed several editions, so that the work must have been popular. In 1575 he left his high patron, archbishop Parker, but his mind was so ardently engaged in his antiquarian studies, that he prosecuted them with unintermitting diligence and zeal, amidst all the inconveniences and difficulties of penury. In 1583 he presented a petition to the lord mayor and court of aldermen, stating that for 25 years he had been employed in compiling and publishing divers pamphlets, recording the memorable acts of famous citizens, and that he contemplated the publication of a larger summary, and soliciting encouragement and assistance; and four years after he presented another petition, requesting a pension, or some other benefaction; but it does not appear whether or not he succeeded in his applications.

To the improvement of the second edition of the Chronicles published by Hollingshed in 1587, Stow largely contributed; and he also supplied corrections and notes for two editions of Chaucer. His "Survey of London, &c.," on which he had been long employed, appeared in 1598, and a second edition was prefixed to the public before his death. It was several times reprinted, with successive improvements, and has been the basis of all the subsequent histories of the metropolis. For his large Chronicle or History of England he had been for 40 years collecting materials; but he only lived to print an abstract of it in 1600, entitled "Flores Hafioriarn, or Annals of England," 4to. dedicated to archbishop Whitgift. Edmond Howes published from his papers a folio volume, entitled "Stow's Chronicle," but this does not seem to contain that "far larger work," mentioned by Stow, and which he left in his study fairly written out for the press. It is said to have come into the possession of Sir Symonds Dews, but is not found among his MSS. in the British Museum. Stow having spent his patrimony, and acquired no certain income, sunk into wretched penury in his old age, and was under a necessity of applying for public charity; and James I., "by one of the meanest acts of his very mean reign," granted a licence, authorizing him, then in his 78th year, "to repair to churches, or other places, to receive the graces and charitable benevolence as well as the bounty of the people." In the amount of this bounty, we may form some conjecture from the collection in the parish of St. Mary Woolnoth, which reached the sum of 7s. 6d. The city of London was not more liberal than the sovereign of the country; and it must reflect no small degree of reproach upon it, that it could not extend its liberality towards its own historian. Stow, oppressed by poverty and painful diseases, obtained a release in the year 1605, at the age of 80 years. His aspect is said to have been cheerful, and his behaviour mild and courteous. In his writings, "says one of his biographers, "he displayed a sincere love of truth, and great diligence in investigating it, with the moral feelings of a worthy man. His brother antiquarians speak of him with respect; and, if he ranks, in point of style and matter, with the inferior class of historians, he may claim the praise of humble utility."—Biog. Brit. Gen. Biog.

STOW, in Geography, a township of Middlesex county, in the state of Massachusetts, incorporated in 1683, and containing 889 inhabitants; 26 miles N.W. of Boston.—Also, a township of Vermont, in Chittenden county, about 25 or 30 miles E. of Burlington, containing 650 inhabitants.

STOW, one of the eight townships into which Cumberland county, in New Jersey, is divided, containing 1039 inhabitants.—Also, a river of New Jersey, which runs into the Delaware, N. lat. 39° 28'. W. long. 75° 26'.

STOWAGE, the general arrangement of the several materials by which a ship is to be laden, with regard to her figure, magnitude, and solidity.

The knowledge of stowing a ship's hold with propriety requires
requires the greatest attention of the skilful mariner; for although it is well known that ships in general will not carry a sufficient quantity of sail, till they are laded so deep that the line of flotation is well with the extreme breadth amidships, or nearly so, yet there is more than this general knowledge required; for should the cargo consist of very heavy materials, as lead, iron, &c., and they be unskilfully flowed too near the bottom, it will place the centre of gravity too low; and although this will enable her to carry a great prew of sail, she will nevertheless roll heavily, and consequently rill the lodging of her masts. On the other hand, should the cargo be light, it is very evident that, without a sufficient quantity of heavy ballast, or other materials of like weight, flowed low down in the vessel, the ship would be in that state, that the centre of gravity would be raised too high, whereby the vessel is rendered incapable of carrying sail without being exposed to the danger of overfletting.

Thus the whole art of flowing or lading a vessel, therefore, consists in placing the centre of gravity to correspond with the trim and shape of the vessel, so as neither to be too high nor too low; neither too far forward, nor too far aft: thus it will be readily seen, that all the weightier part of the cargo should be placed as near the midships as possible, flowing low down in the vessel, at the fore-part of the vessel, and likewise close aft: hence, if the vessel be judiciously flowed, the wind neither roll nor pitch heavily, and will be enabled to carry a good sail and ply well to windward, especially if due regard has been paid to these qualities in the construction of the vessel. See BALLAST.

Stowage Room, in Hop Management, the apartment or place constructed for receiving and containing the hops, after they have been dried, until they are ready or in proper condition for bagging. It has a suitable hole made in some part of the floor, round which a frame of wood is placed, so as to exactly fit the corners of the bags, which are securely fixed all round to it, for the convenience of flowing the hops into them. See Hop.

Stowe, in Geography, a parish in the county of Buckingham, England, three miles N.W. of the town, is noted for the magnificent seat of the marquis of Buckingham. Peter Temple, esq. was the first of the family who settled at Stowe in the year 1554, and who erected a manor on the estate; but this was taken down and rebuilt by Sir W. B. R., who died in 1569. His son, lord Cobham, enlarged the manor, running a new wing, adding two wings; but the late marquis of Buckingham, and his father, earl Temple, made still greater alterations and improvements at this place. The whole front, of regular and uniform architecture, now extends 916 feet, of which the centre is 454 feet. It consists of a centre, or body, with two wings, connected by apartments. A flight of 31 steps leads to the grand saloon, an oval apartment, 60 feet by 40, surrounded by Scaliola columns, imitative of Sicilian Jasper. The panells, cornices, and dome, are all adorned with sculpture and other ornaments, to produce a splendid effect. A statue gallery, 50 feet by 32; a statue gallery, 70 feet by 24; a library; and several drawing rooms, dining-rooms, &c. constitute the principal floor. A library, fitted up to receive Saxon MSS. and old literature, has recently been formed here from the desigms of John Soane, esq. Most of the apartments are enriched with pictures, and fitted up in a splendid style. The gardens or pleasure-grounds of Stowe are, however, more celebrated than the mansion; they consist of 400 acres, and present a great variety of surface, scenery, and objects. In some places they display bold cliffs, with narrow and winding valleys; the principal of which is filled with a broad and pellucid lake. In one part this forms a cascade, and over it is a Palladian bridge. In different parts of the garden are several ornamental buildings, confiding of temples, columns, &c. The beauties and characteristic features of this justly noted seat have been extolled in the poetry of Weel, Pope, and Hammond; and are fully describ'd in an octavo volume, published in 1797, entitled "A Description of the House and Gardens of Stowe," with thirty-three plates, most of which were drawn and engraved in a tasteful style by T. Midland. An account of it is also given in the first volume of the Beauties of England and Wales.

Stowey, near Frome, a small market-town in the hundred of Williton and Freemans, in the county of Somerset, England, is situated eight miles W.N.W. from Bridgewater, and 140 miles W. from London, at the foot of Quenstock hills, on the banks of a rivulet, which passing through Fiddington, falls into the Bridgewater river at Combwich. The town consists of three streets, and was returned to parliament, in the year 1811, as containing 179 houses, occupied by 620 persons. A weekly market is held on Tuesdays, and an annual fair for cattle. Here is a small market-cross, of an octagonal form, standing on eight small round pillars, with a clock, and a bell, which is rung to proclaim the opening up of the town. There is a small market-cross, of an octagonal form, standing on eight small round pillars, with a clock, and a bell, which is rung to proclaim the opening up of the town. As the church stands a quarter of a mile from the town. "Stowey is a reputed borough, the inhabitants whereof have long held their houes and lands of the castle by burgage. The castle stood on a hill to the westward of the town, and near it was a church dedicated to St. Michael; but both are now ruined, so that no vestige remains of either but the castle-ditch; the site of the castle being pastoral-ground." The present church, St. Mary's, is a substantial edifice, having at the west end an embattled tower, 70 feet in height, with a turret at one corner. Colloft's History of Somerset, vol. iii. p14.

Stow-Market, a town in the hundred of Stow, and county of Suffolk, England, is seated at the junction of three rivulets, which form the river Gipping. In 1801 it contained, according to the parliamentary report, 283 houses, and 1763 inhabitants; and by the report of 1811, these appear to have increased to 2000 persons, and 401 houses. Stow-Market is certainly a flourishing town, and contains many handsome houses, especially near the market-place. The church is a spacious and beautiful building, with a square tower, surmounted by a new spire, of two stories high, which, though of wood, has a light and neat appearance. In this church are interred several of the Tyrrell family, of Gipping-Hall, in this hundred. Here also is the monument of Dr. Young, once vicar of this place, and tutor to the immortal Milton. The contiguous parish of Stow-Uplands, which has neither church nor chapel, is now consolidated with Stow-Market; but they have full distinct officers for each parish.

The county meetings for Suffolk are chiefly held in this town; and here is a manufacture of fanning, ropes, twines, and hampen, which has succeeded that of fluffs and bome-bazenas. Being well situated for the barley trade, the market of this town is much frequented by the farmers, and much business is done in the malting line. A principal source of the prosperity of Stow-Market is the navigable canal from this place to Ipswich, which was opened in 1793.

It is sixteen miles in length, and has fifteen locks, each sixty feet long, and fourteen wide; three of these are built with timber, and twelve with brick and stone. The total expense of this undertaking was 26,980l. Independently of its utility, this canal is an ornament to the town. There are about 150 acres of hop-plantsations in this neighbourhood.
STO

An old manor-house, called Abbot's-Hall, together with the manor of Stow-Market, were given by King Henry II. to the abbey of St. Oysth, in Essex; but was granted, 38 Henry VIII., as part of the poffeifion of that monastery, to Thomas Darie. The house of industry for the hundred of Stow stands on an eminence, about a mile from the town. It has rather the appearance of a gentleman's seat than of a receptacle for paupers. It was erected at an expenditure of more than 12,000l. and was opened in 1791.

Bookhall, near Stow-Market, was the birth-place of Sir William Copping, lord mayor of London in 1512. At his death, he bequeathed half of his large property to charitable purposes; the other half was devoted to his relations. Finchborough-Hall, in the parish of Great Finborough, was built in 1795, by the present proprietor and lord of the manor, Roger Pettitward, esq. An embowered walk leads behind the hall to the church, which contains several monuments of the Wollaston family, formerly proprietors of Finborough; and particularly one to the memory of William Wollaston, author of the "Religion of Nature delineated," who resided and is interred here. He was born in 1659, at Coton Clifton, in Staffordshire, and died in 1724.

The hamlet of Gipping derives its name from its situation near the source of one of those springs that form the river Gipping. It was once the seat of the ancient family of Tyrrle, whose residence, Gipping-Hall, is now held by Sir John Shelly, bart. Haugley was formerly a market-town, out of the ruins of which Stow seems to have risen. Near the church stand the remains of a very strong castle, constructed to have been built by the Saxons. The figure of the building approaches that of a square, fortified with a deep ditch, or moat; and, except on the north side, a proportionable rampart, full-entire. Towards the north, upon a high artificial hill, a steep ascent, and also surrounded with a deep moat, flood the keep; of which the foundation, now remaining, is very thick, and apparently circular. On the west side, a large oblong-square space seems to have contained some outwork of the castle. The ground occupied, or inclosed by all these works, exceeds seven acres. The manor and park of Haugley formerly belonged to Charles Brandon, duke of Suffolk; from whom they devolved by purchase, or exchange, to the crown; and were afterwards granted to Sir John Sulyard, of Wetherden. The manor is very extensive, and the lord formerlypossessed a power of trying all causes in his own court of oyer and terminer. Beauties of England and Wales, vol. xiv. Suffolk, by F. Shooben.

STOW-ON-THE-WOLD, a market-town and parish in the hundred of Welfordminster, and county of Gloucester, England, is irregularly built on the summit of a high hill, the base of which is about three miles in diameter. From this elevated situation it is generally said to want three elements out of the four; fire, earth, and water: air it possesses in plenty, and, though uncommonly sharp, it is reputed to be very healthful. Water is scarce, especially since the decay of an horizontal windmill at the north end of the town, which formerly raised it from a very deep well, and forced it through pipes to the houses. The charter for the market was granted, in the fourth year of Edward III., to the city of Evesham; by which establishment for part of the manor was held in the time of Edward the Confessor; and within a century, it had obtained possession of the remainder. The manor now belongs to Edmund John Chamberlayne, esq., a descendant of a respectable family of Norman extraction, who settled in the hamlet of Maugersbury, on the east side of Stow, in the time of queen Elizabeth; and one of whom, Edmund Chamberlayne, esq., was sheriff of this county in the 39th year of that sovereign.

The church is a well-built edifice, apparently the workmanship of different periods during the fourteenth and fifteenth centuries. It consists of a nave, aisles, and chancel, with an embattled tower on the south side, 82 feet in height, which, from its lofty situation, constitutes a principal object through a circumference of many miles. The arches are pointed, and supported by clustered pillars. At the east end is a rich window of quatrefoils; and at the west a window of ovals, with two trefoils in each. Several monuments and inscriptions, to the memory of the Chamberlaynes, are contained in this edifice; and in the midst of the chancel is a large altar-tomb, in remembrance of Duke Haftings Key, of Ebington, an officer on the part of Charles I., who died in the year 1645. His effigy in armour is engraved on the slab which covers the tomb.

The principal charitable institutions are an almshouse for nine poor persons, and a free-school; both situated on the south side of the church-yard. The former was founded under the will of William Chestre, dated as early as the sixteenth of Edward IV. Ailmer, or Ethalmer, earl of Cornwall and Devon, in the tenth century, the reputed founder of the original church in this town, is also said to have erected an hospital here, which Rudder mentions as being yet charged in the First-fruits office with the annual sum of 132. 4d. The population of Stow, as returned under the act of 1811, amounted to 1188; the number of houses to 264: the latter are mostly low, and built with stone, and have generally a very ancient appearance. The principal manufacture is that of flax.

At Adlethrop, or Adelthorpe, about three miles east of Stow, is the seat of James Henry Leigh, esq., a lineal descendant of Sir Thomas Leigh, to whom the manor, which had previously belonged to the abbey of Evesham, was granted in the year 1554. The manor is a very ancient building, but has been much enlarged, and otherwise improved. The pleasure-grounds have been laid out by Mr. Repton. About three miles south of the town is an old encampment, called an Inman-camp.—Beauties of England and Wales, vol. v. by J. Britton and E. W. Bralyce.

STOWRE, in Rural Economy, a term signifying a round of a ladder; a hedge-latch; also the flaves of the sides of a waggon, in which the eave-rings are fastened. It also signifies a staff or round stick, such as a tuck or rack staff.

STOWS, in Mining, are seven pieces of wood, set upon the surface of the earth, fastened together with pins of wood. See Spindle.

STRABANE, in Geography, a post-town of the county of Tyrone, Ireland, situated on the river Mourne. It is a flourishing town, and has a good market for many articles, especially linen cloth. Its canal, connecting it with the navigable river Foyle, is a principal cause of its prosperity, which is daily increasing. Strabane, before the union, was represented in parliament. It is 101 miles N.N.W. from Dublin.

STRABANE, two townships of Pennsylvania, one in Adams' county, the other in that of Washington; the latter containing 2595 inhabitants.

STRABISMUS, strabismus, in Medicine. See Squinting.

STRABO, in Biography, a celebrated geographer, was born at Amafax, a city of Pontus, but in what year we cannot ascertain. From his acquaintance with C. Gallus, preferent...
prefect of Egypt; and from his having composed his geography in the fourth year of the emperor Tiberius, we may infer that he flourished in the century B.C.; and Blair assigns his death to the year 25 before the commencement of the Christian era. It appears that he studied grammar and rhetoric at Nysa, and that he was instructed in the principles of the various sects of philosophers in several of the most celebrated schools of Asia. He owns himself a Stoic, and he followed their dogmas. Of the general course of his life little is known; but he appears to have been a vast traveller, and to have visited most of the countries which he describes. Besides his Geography, contained in seventeen books, which was written in his advanced age, and which is highly valued, he was the author of some historical works, which have been lost. His Geography, though since the time in which he lived it must be imperfect and erroneous in various particulars, is very useful for the illustration of the history and writings of the ancients; more especially as he interjects many philosophical remarks, which indicate a cultivated mind, and many short narratives, which serve to satisfy youth with acquaintance with the history and antiquities of remote periods.

Several editions of a Latin version of Strabo appeared before the Greek text was printed. Of the Greek and Latin editions, the first that claims commendation for its erudition was that of II. Cafaubon, fol. Genev. 1587, and Paris, 1620. That of Janfson al Velomeoven, cum notis variouis, Amst. 2 vols. fol. 1707, is much esteemed, though not very correct. An Oxford edition has lately appeared, under the inspection of Mr. Falconer. Fabr. Bibl. Grec. Gen. Biog.

Strabo frequently mentions music, and the illustrious musicians of antiquity, with great respect. He places Zeno at the head of all science; and says, that the principal invention of the poet does not consist in teaching, but in delighting mankind. Whereas, according to the more ancient fages, poetry was a first philosophy, which conducted youth through a plesant path to prudence, morality, manners, human affections, and social laws; while the moderns of our times (adds Strabo) say, that wisdom is only to be found among poets; on which account, the cities of Greece teach poetry to youth before all other things, not only for pleasure, but as a useful and virtuous discipline. In the same manner, musicians, while they are teaching to sing and play on instruments, making this faculty a profession, are called masters, and correctors of manners. And this was not only the opinion of Pythagoras, but is manifestly demonstrated by Aristoxenus; and for this reason Homer placed a musician over Clytemnestra, as a guardian and guide of her conduct. All this has been copied from Strabo by Athenaeus, l. c. 17.

But though a grave and solid writer, and a Stoic, Strabo has related a story in his fourteenth book, which throws a ridicule, not only on an eminent individual musician, but on the pretended lovers of music. He says that in Greece, near Bargilla, on the sea-coast, there was a market-town in a barren country, in which the inhabitants subsisted chiefly on fish; and a great performer on the cithara passing that way, willed to display his talents in public. On notice being given, the inhabitants assembled in great crowds to hear him. But soon after he had begun to perform, on hearing the fish-market bell, the audience hurried away, and left the citharist only one solitary person behind, who had not heard the bell, for he was deaf. The musician complained of his ill-treatment, butfinished by saying to the remaining gentleman, "Kind sir! I thank you for your politeness, in staying after all the rest had left me; but I perceive that you are a man of taste, a true lover of music, and did not run away in the midst of my performance, merely because the fish-bell rung." "What do you say? Why, has it rung?" demands the deaf gentleman: and the performer answering in the affirmative—"Oh, then, I wish you a good day, sir!"—and hastened to the market as fast as he could.

STRABRAGY, in Geography, a bay on the north coast of Ireland, in the peninsula of Inishowen, and county of Donegal. It is south of Malin head, and the village of Malin is situated on it.

STRACAIA, a town of Walachia; 18 miles N.W. of Krajova.

STRADA, FAMIANO, in Biography, a celebrated Italian writer, born at Rome in 1572, who entered into the society of Jesus in 1592, and became professor of eloquence in the Roman college, where he resided till his death in 1659. His most famous work was a "History of the Wars in the Low Countries," in Latin, consisting of two decades: the first, comprizing the events from the death of Charles V. to the year 1573; and published in 1654; and the second, as far as 1590, published in 1647. Strada's work was criticized with some severity by Cardinal Bentivoglio; and it is allowed to have been more the production of a rhetorician than of an impartial and correct historian. The style, however, is animated, and the language pure, though defective in the good taste of some other modern Latinists. It was attacked with virulence by Gaspar Scipionius, in his "Infamia Famiani Strade," which injured his own reputation more than that of the historian.

The "Prolusions Ad Arabicam" of Strada, containing various dissertations on literary subjects, is an ingenious and elegant performance, particularly admired for its imitations of the most celebrated Latin poets. Addifon pronounces this effusion to be "one of the most entertaining, as well as the most just pieces of criticism he had ever read;" and he has made it the subject of three papers in the Guardian. Tirabocchi. Gen. Biog.

STRADA, or STRADANUS, an eminent painter of a good family, was born at Bruges in the year 1536; and after residing in his own country, visited Italy for further improvement in painting. At Florence he was employed in some considerable works, and thence he went to Rome, where he painted at the palace of Belvidere in concert with Dan. da Volterra and Fr. Salviati. In compliance with the invitation of Don John of Aufris, he visited Naples, and accompanied his patron to Vienna, where his pencil was employed in commemorating that great officer's military exploits. He afterwards fixed his residence at Florence, where he became the head of the Florentine academy of painting; and he died in 1604. Besides history-pieces, he painted animals, hunting, and battles, in a noble style, with good drawing, and an agreeable tone of colouring. Although he may be considered as a competitor in a variety of respects with the celebrated artists of his time, he could never direct himself wholly of the Flemish taste which he had imbibed in his youth. Many of his pieces are engraved. Pilkington.
was announced in Handel's advertisement among the other
tingers of his troop in the following manner: "Signora
Strada, who hath a very fine voice, a person of singular me-
rit." This finger had many prejudices to combat on her
first arrival in this country; the enemies of Handel were of
course unwilling to be pleased with any part of the ent-
tertainment he had provided for the public; the abilities of
Cuzzoni and Faustina had taken possession of the general
favour; and Strada's personal charms did not allude her much
in conciliating parties, or dispelling the eye to augment the
pleasures of the ear; for she had so little of a Venus in her
appearance, that she was usually called the pig. However,
by degrees she subdued all their prejudices, and fended herself
into favour, particularly with the friends of Handel, who
used to say, that by the care he took in composing for her,
and his instructions, from a coarse finger with a fine voice,
he rendered her equal at least to the first performer in
Europe.

She first appeared in the opera of "Lotharius;" and in
examining the original score, her first air, "Quel cor che
mi donasti," seems chiefly calculated to display her fine
and brilliant voice, for which there are more than thirty occasions
given in the course of the song.

The Strada performed for Handel at Oxford, in the ora-
torio of Athalia, and in his three first oratorios that were
publicly performed in London. She left England in 1741,
and returned to Italy, leaving behind her great, and,
believing, well-merited fame, for the accuracy and spirit of her
voice.

STRADAN, in Geography, a town of Prussia, in the
province of Oberland; 3 miles N.W. of Eylau.
STRADANEN, a town of Prussia; 6 miles N. of
Lick.

STRADAUN, a town of Prussia, in Natangen; 9
miles S.W. of Marggrabowa.
STRADALLY, a post-town of Ireland, in the
Queen's county, on the mail-coach road to Cork, by way of
Cahel. There is a charter-school here for 50 boys, and
the town is neat, and tolerably flourishing. It is 59 miles
S.S.W. from Dublin.

STRADELLA, Alessandro, of Naples, in Biogra-
phy, was not only an excellent composer of the seventeenth century,
but a great performer on the violin, and besides these qualifications, he was possessed of a fine voice, and an
exquisite manner of singing. His compositions, which are
all vocal, of which we are in possession of many, and have
examined a great number more in other collections, seem
inferior to any that were produced in the last century, except
by Carissimi; and, perhaps, if he had enjoyed equal longevity, he would have been inferior in no respect to
that great musician.

Though it has been said by Bourdelot, in his "Histoire
de la Musique," tom. i. p. 41. and by others after him, that
Stradella was engaged by the republic of Venice to compose
for the opera in that city; it does not appear by the correct
and regular lift of the musical dramas performed at Venice
from the year 1637 to 1730, that an opera, or any part of
an opera, of his composition, was ever performed in that city.
Nor does his name occur as a dramatic composer for any
other part of Italy, in the "Drammaturgia" di Lione
Allacci, augmented and continued to the year 1755. His
compositions are chiefly miscellaneous, consisting of single
songs, cantatas, duets, trios, and madrigals of four and
five parts. One opera, and one oratorio, include the whole
of his dramatic music, sacred and secular, which we have
been able to find.

This musician, probably at an early period of his life, having
acquired great reputation at Venice by his talents, was em-
ployed by a noble Venetian to teach a young lady of a noble
Roman family, named Hortensia, to sing. This lady, on
whose nature had beflown a beautiful person and an exquisite
voice, notwithstanding her illibritious birth, having been
instructed from her friends, had submitted to live with this Ve-
netian in a criminal manner.

Hortensia's love for music, and admiration of the talents
of her instructor, by frequent acces, soon gave birth to a
passion of a different kind; and, like Heloïsa, she found,
that though at first

Guilteles she gaz'd, and listen'd while he sung,
While science flow'd seraphic from his tongue);

"From lips like his the precepts too much more,

They music taught—but more, alas! to love!

and accordingly she and her master became mutually en-
married of each other. Before their secret was disclosed,
of which the consequences might have been equally fatal to
Stradella with those which followed the discovery of Abe-
lard's passion, they agreed to quit Venice together, and fly
to Naples; and after travelling in the most secret manner
possible, they arrived at Rome in their way to that city.
The Venetian seducer, on discovering their flight, deter-
mined to gratify his revenge by having them assassinated in
whatever part of the world they could be found; and
having engaged two desperado ruffians to pursue them, by
a large sum of ready money, and a promise of a still greater
reward, when the work was accomplished, they proceeded
directly to Naples, the place of Stradella's nativity, sup-
posing that he would naturally return thither for shelter,
preferably to any other part of Italy. But after seeking him
in vain for some time in that city, they were informed that he
and the lady were still at Rome, where she was regarded as his
wife. Of this they communicated intelligence to their em-
ployer, affurting him of their determination to go through
with the business they had undertaken, provided he would
procure them letters of recommendation to the Venetian
ambassador at Rome, to grant them an asylum as soon as
the deed should be properly executed.

After waiting at Naples for the necessary letters and in-
structions, they proceeded to Rome, where, such was the
celebrity of Stradella, they were not long before they dis-
covered his residence. But hearing that he was soon to con-
duct an oratorio, of his own composition, in the church of St.
John Lateran, in which he was not only to play, but to sing
the principal part; and as this performance was to begin at
five o'clock in the evening, they determined to avoid them-
selves of the darkness of the night when he and his miltrefs
should return home.

On their arrival at the church, the oratorio was begun,
and the excellence of the music, and its performance, joined
to the rapture that was expressed by the whole congregation,
made an impression and softened the rocky hearts even of
these savage beasts to such a degree, as to incline them to
revisit; and to think that it would be a pity to take away
the life of a man whose genius and abilities were the delight
of all Italy—an inliance of the miraculous powers of mo-
dern music, superior, perhaps, to any that could be well au-
thenticated of the ancients.

Both these affinities being equally affected by the perform-
ance, alike inclined to mercy, and accosting him in the
street when he quitted the church, after complimenting him
upon his oratorio, confessed to him the business on which
they had been sent by the Venetian nobleman, whose miltrefs
he had stolen; adding, that charmed by his music, they had
changed their minds; and then, advising him and the lady
to fly to some place of safety as soon as possible, they determined to relinquish the rest of the reward that was promised them, and tell their employer that Stradella and his mistress had quitted Rome the night before their arrival in that city.

After this wonderful escape, the lovers did not wait for new counsel to quit Rome, but set out that very night for Turin, as a place most remote from their implacable enemy and his emissaries. And the affinias returning to Venice, told the enraged Venetian that they had traced the fugitives to Turin, a place where the laws being not only few, but the difficulty of escaping so much greater than in any other part of Italy, on account of the garrisons, they should decline any further concern in the business. This intelligence did not, however, incline the offended nobleman to relinquish his purpose, but rather stimulated him to new attempts: he therefore engaged two other affinias in his service, procuring for them letters of recommendation from the abbé d'Estrade, at that time the French ambassador at Venice, addressed to the marquis de Villars, ambassador from France to Turin. The abbé d'Estrade, struck with the resolves of the Venetian ambassador, protection for two merchants, who intended to reside some time in that city, which being delivered by the new affinias, they paid their court regularly to the ambassador, while they waited for a favourable opportunity to accomplish their undertaking with safety.

The duchies of Savoy, at this time regent, having been informed of the sudden flight of Stradella and Hortensia from Rome, and their arrival at Turin, and knowing the danger they were in from the vindictive spirit of their enemy, placed the lady in a convent, and retained Stradella in his palace, as a situation apparently so secure, Stradella's fears for his safety began to abate; till one day, at six o'clock in the evening, as he was walking for the air on the ramparts of the city, he was set upon by two ruffians, who each gave him a stab on the breast with a dagger, and immediately flew to the house of the French ambassador, as to a sanctuary.

The assault having been seen by numbers of people who were walking in the same place, occasioned such an uproar in the city, that the news soon reached the duchies, who ordered the affinias to be hunted, and the marquis de Villars having been informed by the surgeons that he would recover, in order to prevent any further dispute about the privileges of the corps diplomatique, suffered the affinias to escape.

But such was the implacability of the enraged Venetian, that never relinquishing his purpose, he continued to have Stradella constantly watched by spies, whom he maintained in Turin. A year being elapsed after the cure of his wounds, and no fresh disturbance happening, he thought himself secure from any further attempts upon his life. The duchess regretted, interesting herself in the happenings of two persons who had suffered so much, and who seemed born for each other, had them married in her palace. After which ceremony, Stradella having an invitation to Genoa, to compose an opera for that city, went thither with his wife, determining to return to Turin after the carnival; but the Venetian being informed of this motion, sent affinias after them, who watching for a favourable opportunity, rushed into their chamber early one morning, and stabbed them both to the heart. The murderers having secured a bark, which lay in the port, by instantly retreating to it, escaped from justice, and were never heard of more.

This tragic event must have happened considerably later than 1670, the date that has been affixed to it by all the liberal writers who have related the story. For being in possession of the drama which he set for Genoa previous to his murder, which is entitled "La Forza dell' Amor paterno," and dated Genoa, 1678, it appears that the dedication of this opera to Signora Tereza Raggi Saoli, was written by Stradella himself. And at the conclusion of the editor's advertisement to the reader is the following eulogium on the composer of the music: — "Battendo il diritto, che il concerto di pari perfezione sia valore di un Allemandro, cioè del signor Stradella riconosciuto senz' altro contratto per il primo Apollo della musica." — "Nothing further need be offered in defence of the work, than to say that it had received the advantage of the perfect melody and harmony of an Alexander, that is, of signor Stradella, indubitably acknowledged to be the magnus Apollo of music."

His oratorio of "San Giovanni Battista, a 5, con ari...mendi," which is generally believed to have saved this charming composer's life, being minutely described, and in a manner reviewed, in Burney's History of Music, vol. iv. p. 105, we must refer our curious readers to that work, where a considerable part of this oratorio is printed, together with a list of other excellent productions by this admirable master, preferred in different collections in our public and private libraries; and the more we examine the productions of this gifted musician, the more we are convinced that Purcell made him his model; not in detail, in order to imitate his passages, but in his general style of composition. Purcell was extremely fond of writing upon a ground-bass, a species of chaconne, which the Italians call basso coffrente, and the French basse-contreinte: and in Stradella's oratorio, it appears that more than half the airs in that admirable production are built upon a few bars or notes of base perpetually repeated. Purcell may have been influenced to exercise his powers in such composed and difficult enterprises as themes, by viewing the works of an author, who, according to tradition, was his greatest favourite; but he has never made use of the fame ground, or series of notes, in any of his numerous compositions of this kind: indeed Purcell's ground-basses are not only new, but in general more pleasing and difficult to treat, than those of any other composer of his time.

Stradella, in Geography, a town of Italy, near the Po; 9 miles E.S.E. of Parma.

Strafford, a township of America, in Orange county, Vermont, containing 1805 inhabitants; 20 miles N.N.W. of Norwich.

Strafford, a county of New Hampshire, watered by branches of the Piscataqua and Merrimack, containing 41,595 inhabitants. The chief towns are Dover and Durham.

Stragnes, a town of Sweden, in Sudermanland; 31 miles W. of Stockholm.

Strather, a town of Scotland, in the county of Argyll, situated on Loch Fine, opposite to Inverary.

Strahlstein, in Mineralogy, Attilianite, Jameston.

Ambibolite Atitace, Hauy. This mineral is classed by Hauy with hornblende, on account of the identity which he supposes to exist in the forms of the primitive crystals of both:
both: this identity is, however, denied by the count de Bournon. Werner makes a distinct species of strahlenstein, which he divides into four sub-species: common austinolite, glassy austinolite, granular austinolite, and effusible austinolite. The three former appear to differ only in their structure; the latter more nearly resembles achatolite.

The colour of austinolite is principally leek-green or grass-green, but sometimes olive-green and greenish-white.

Common austinolite, Gemeiner strahlenstein, is never regularly crystallized: it occurs in beds in rocks of gneiss, mica-flate, and talcous slate, and in small veins or disseminated in trap-rocks. It has a divergingly foliated, or promiscuously radiated structure, with a double cleavage, forming oblique angles. Its internal luster is shining; it is more or less translucent or transparent; it fractures glass, and melts before the blow-pipe into a greyish-green or blackish glass. The specific gravity of this mineral is about 3.4.

Glassy austinolite, Glaseriger strahlenstein, occurs massive and crystallized in very oblique four-sided prisms; the edges are generally truncated. The crystals are small, and most frequently either divergingly aggregated, or reiting on each other. In the fibrous varieties, the fibres are sometimes parallel. The luster is vitreous, slightly inclining to pearly. The crystals are translucent, and very brittle. Before the blow-pipe it melts with difficulty into an opaque, green-coloured glass.

The constituent parts of this mineral, from Zillerthal, in the Tyrol, as given by Langier, are:

- Silex: 50
- Magnesia: 19.25
- Alumine: 0.75
- Lime: 0.15
- Potash: 0.25
- Oxyd of iron: 11.00
- Oxyd of manganese: 0.50
- Oxyd of chrome: 3.00
- Carbonic acid and water: 5.00
- Lofs: 0.15

Granular austinolite, Korniger strahlenstein, occurs massive, in large, coarse, and small granular distinct concretions, along with precious garnet and quartz, in the Salzpe and Tainach, in Stria. The luster is shining and vitreous. The cleavage is double; the structure in the direction of the principal joint is foliated. The cross-fracture is splintery. It is hard and brittle. It is fairly translucent.

Effusible austinolite, Effusatiger strahlenstein, Werner. Austinolite aciculaire, Haitiy. The colour is a greenish-grey, which passes into sky-blue, and into olive-green, and yellowish-brown and liver-brown. It occurs in distinct wedge-shaped concretions, composed of acicular crystals, which are diverging or radiated. It is opaque, or slightly transluent on the edges. Internally the luster is glintening and pearly. It is soft, rather delicate, and breaks with difficulty. The specific gravity of effusible austinolite is 2.8, Karsten; according to Kirwan, 2.759. It melts with difficulty into a black or dark green-coloured glass. The constituent parts, according to Vanquelien, are:

- Silex: 47.0
- Lime: 11.5
- Magnesia: 7.3
- Oxyd of iron: 20.0
- Oxyd of manganese: 10.0
- Lofs: 4.4

The variety of which the analysis is given, is composed of thin, elastic and flexible crystals, and is called by Saffure byfolite. It occurs in Norway, Sweden, in the Hartz, and various alpine districts, in rocks of gneiss, mica-flate, and granular lime-flint; it occurs also near Maraffon, in Cornwall. The colouring matter of crystallized austinolite appears from the analysis of Langier, to be chrome; this is also, in all probability, the colouring matter of the other varieties. The hexagonal prisms of austinolite are commonly of a beautiful green, imbedded in white talc. Austinolite occurs at Glenelg, in Inverness-shire, and in the Isle of Skye, and disseminated in trap, in Shropshire. The mineral with which austinolite or strahlenstein is most likely to be confounded, is thellite or epidote. For the distinctive characters of each, see Thellellite.

STR. STRAIGHT, STRAIGHT, or STRAIT, in Hydrography, a narrow channel or arm of the sea, shut up between lands on either side, and affording a passage out of one great sea into another.

There are three kinds of straits. 1. Such as join one ocean to another. Of this kind are the straits of Magellan and Le Maire. 2. Those which join the ocean to a gulf: the straits of Gibraltar and Babelmandel are of this kind, the Mediterranean and Red Sea being only large guls. 3. Those which join one gulf to another; as the strait of Cape, which joins the Falus and the Euxine, or Black Sea.

The passage of straits is commonly dangerous, on account of the rapidity and opposite motion of currents.

The most celebrated strait in the world is that of Gibraltar, which is about one hundred and thirty miles long, and twelve broad, joining the Mediterranean sea with the Atlantic ocean.

The straits of Magellan, discovered, in 1520, by F. Magellan, were used some time as a passage out of the North into the South sea; but since the year 1616, that the strait of Le Maire has been discovered, the former has been diffused; both because of its length, which is full three hundred miles, and because the navigation of it is very dangerous, from the waves of the North and South seas meeting in it and clashing.

The strait at the entrance of the Baltic is called the Sound; which see: that between England and France, Le pas de Calais, or the Channel. There are also the straits of Babelmandel, of Weigats, of Jello, of Anian, of Davis, and Hudson, &c.

Straight is also used, in Geography, for an ilemus or neck of land between two seas; preventing the communication thereof.

Highwater is a name applied to the straits of the North Sea.

STR. Straight, or Straight, in Geography, a river of America, which runs into the Ohio, N. lat. 38° 38'. W. long. 84° 2'.

STRAIKS, in the Military Art, are strong plats of iron, fix in number, fixed with large nails, called streik-naile, on the circumference of a cannon-wheel, over the joints of the fellow, both to strengthen the wheel, and to save the fellows from wearing on hard ways or streets.

STRAIN, or SPRING, a violent extenstion of the fine or tendon of some muscle. See SPRING.
STR

STRAIN, among horses and other animals, an over-dilatation of the muscles, proceeding from slips, blows, or from hard riding in the horse. It may be observed, that in all strains, the muscular or tendinous fibres are over-stretched, and sometimes ruptured, or broken.

It is evident, that in all violent strains, either of tendons or muscles, whatever opinions may have been entertained of bathing and anointing with favourite remedies, which often succeeded in slight cases, where perhaps bondage alone would have answered; the latter, with properly relieving the relaxed fibres till they have thoroughly recovered their tone, are chiefly to be depended on; and frequently some months are necessary for effecting the removal of the complaint. All such violent strains of the ligaments which connect the bones together, especially those of the thigh, require time, and turning out to graze, to perfect a recovery. External applications can avail but little here, the parts affected lying too deep, and so surrounded with muscles, that neither applications nor medicine can penetrate to them. The foaler, in these cases, the horse or other animal is turned out to graze, the better, as the gentle motion in the field will prevent the ligaments from thickening, and of course the joint itself from growing stiff; nor do we believe that firing, so commonly practised with horses in this case, is of half the consequence as rest, and turning out for a considerable time, which is indeed always advised at the time the horse is fired. Where the shoulder is over-strained, the horse or animal does not put out the leg like the other; but, to prevent pain, sets the found foot hardly on the ground, to serve the other, even though he be turned short on the lame side, which motion tries him the most of any. When trotted or run in hand, instead of pulling the leg forward in a right line, the animal forms a circle with the lame leg; and when the horse stands in the stable, that leg is advanced before the other. The same is the case with other animals. In order to remove this lameness, they should first be bled, and the whole shoulder be well bathed, three times a day, with verjuice, or vinegar; but if the lameness continue without swelling or inflammation, after resting two or three days, it has been recommended that the muscles be well rubbed for some time with opodeldoc, or embrocations compounded of camphor and turpentine, or vinegar, camphor, and spirits of vitriol. Where inflammation and swelling are present, the use of camphorated farinaceous washes may frequently be beneficially employed two or three times in the day, cloths wet with them being applied to the parts.

Strain, in Music, is a section or portion of an air or tune of two or more sections; as first strain, second strain; and sometimes the term implies the whole air; as a beautiful, pleasing, or disagreeable strain.

"That strain again;—it had a dying fall."

STREND SUGAR. See Sugar.

STRAINING. See Sugar.

STRAINING, in Phystiology. See Lungs.

STRAISIN, in Geography, a town of Austria; 7 miles N.W. of Pirawarthe.

STRAIGHT. See Straight.

STRAITS of Calais, one of the twelve departments of the second or northern region of France, composed of Artois, Calais, and Boulogne, lying in N. lat. 50° 30', between the department Du Nord and the British Channel, containing in territorial extent 7,042 square leagues, or 3,28 square leagues; Vol. XXXIV.

or 37 French leagues in length and 15 in breadth, or about 90 English miles in length from N.W. to S.E. and 90 in breadth, and 56,061 inhabitants. It is divided into rix circles or districts, 43 cantons, and 923 communes. The circles are Boulogne, containing 71,304 inhabitants; St. Omer, with 66,763; Bethune, having 64,669; Arras, with 36,380; St. Pol, with 76,061, and Montreuil, including 70,883 inhabitants. According to Haltenbrat, the number of circles is 8, of cantons 85, and of inhabitants 525,789. The capital is Arras. A ridge of low hills extends from Abbeville to Boulogne. The soil of this department is, in general, fertile, yielding all sorts of grain, flax, and pastures.

STRAKES, in Ship-Building, are the regular ranges of planks on the bottom and sides of the ship, or the continuation of planks joined to the ends or butts of each other, and reaching from the stem to the stern-post: the lowest of the over the bottom, called the garboard-strake, is let in to the rabbit of the keel, and into the stem and stern-post. The lowest strake inside is called the timber-strake, which is wrought about eleven inches from the side of the keel, and has a rabbit in the upper edge to receive the ends of the timber-boards.

They say also, a ship beats a strake, that is, when the inclines to one side the quantity of a whole plank’s breadth.

STRAKES, or Streaks, in Mining, are frames of boards fixed on or in the ground, where they wash and dries the small one in a little stream of water, hence called a framed ore.

STRAKONITZ, in Geography, a town of Bohemia, in the circle of Prachatitz; 54 miles S. of Prague. N. lat. 49° 17'; E. long. 13° 50'.
particulars geometry and fortification, he was well versed in various other branches of science. Gen. Biog.

STRALSUND, in Geog., a city of Germany, and capital of Swedifh Pomerania, situated in a strait which passes between the continent of Pomerania and the island of Rugen, founded in 1209, by Jaro Mar, the first prince of Rugen, for the security of his territory on the continent, but soon afterwards destroyed by the dukes of Pomerania. It is a very strong place, being surrounded by the sea so as to be accessible only by bridges, and well fortified. It is the residence of the king's governor-general, of the regency, and war office; and the place where the states of Swedish Pomerania hold their meetings. Its magistracy was ennobled, in 1714, by Charles XII. king of Sweden; and in 1720, king Frederick I. extended the like honour even to the members of the council. It was formerly one of the principal Hanse towns. It has undergone several revolutions; and in August 1807, it was taken by the French; 113 miles N. of Berlin. N. lat. 54° 20'. E. long. 13° 8'.

STRAMBURG, a town of Mecklenburg, in the circle of Pomerania; 30 miles E. of Prerow. N. lat. 50° 31'. E. long. 18° 11'.

STRAMMEHL, or STRAMEN, a town of Hinder Pomerania; 36 miles W. of New Stettin. N. lat. 53° 42'. E. long. 15° 32'.

STRAMONIUM, in Botany, supposed to be a corruption of atyraeum, or mid-nightshade. See Datura.

Datura, in the Materia Medica. See Datura.

Datura, in the Materia Medica.

Under the article now referred to, it has been observed that the plant has been known as a powerful narcotic poison; its congener, the D. metel, is thought to be Euphorbiaceae (strychnus manicus) of Theophrastus and Dioscorides, and is therefore the species received by Linnaeus into the materia medica. In the recent flate, the stramonium has a bitter taste, and a smell somewhat resembling that of poppies, or, as Herbgus says, narcotic, especially if the leaves be rubbed between the fingers. By holding the plant to the nose for some time, or sleeping in a bed where the leaves are fired, giddiness of the head and stupor are said to have been produced. The deleterious effects of the plant, and more especially of the seeds, have been manifested in various instances: and those of the seeds have, in some cases actually upon record, been fatal. Their coprophilous efficacy has been shamefully applied to purposes the most licentious and dishonourable. The effects of the stramonium as a medicine, are to be referred, says Dr. Woodville, to no other power than that of a narcotic. The extract, he says, has been the preparation usually employed, and from 1 to 10 grains, and upwards, a day; but the powdered leaves, after the manner of those directed by hemlock, would seem, he thinks, to be a preparation more certain and convenient. Externally, the leaves of stramonium have been used as an application to inflammatory tumours and burns. Some have thought they have derived benefit from smoking stramonium in asthma and shortness of breath.

STRAND, in Geography, a town of Sweden, in Warmeland; 56 miles N.W. of Carlstadt.—Allo, a town of Norway, in the province of Bergen; 20 miles S.W. of Romdal.—Allo, a town of Sweden, in Warmeland; 20 miles N.W. of Carlstadt.—Allo, a lake of Norway, in the province of Agerhus; 75 miles N.W. of Christiansia.

STRAND, North, a strait of the North sea, between the island of Benbecula and North Uist.

STRAND, South, a strait of the North sea, between the island of Benbecula and South Uist.

STRAND, in Sea Language, denotes one of the twirls or divisions of which a rope is composed. See Rope.

A rope is said to be stranded, when one or more of its strands are so damaged as to be cut through, or nearly so.

Strand also implies the sea-beach: hence a ship is said to be stranded, when, by tempest or bad weather, she is run on shore. This is oftener the case than need be, if proper alinement was given, or one of the following methods were practiced for the safe removal of ships driven on shore. For this purpose, empty casks are usually employed, by being lashed round her under her bottom, to float off the vessel; or a temporary cauing built round her outside, of flanchions and deals caulked, especially if she is small, and at the same time near the port to which it is proposed to conduct her. In other cases, the following method, adopted by Mr. Barnard, will answer. (See Philosophical Transactions, vol. lxx, part 1.) On January 1, 1779, (says Mr. Barnard), in a most dreadful storm, the York East Indianman, of 800 tons, homeward bound with a pepper cargo, parted her cables in Margate road, was driven on shore within one hundred feet of the head and thirty feet of the side of Margate pier, then drawing twenty-two feet six inches water, the flow of a good spring-tide being only fourteen feet at that place.

On the 3d of the same month I went down to affit getting off the ship. I found her perfectly upright, and her sheer (or side appearance) the same as when first built, but funk to the twelve-feet water-mark fore and aft, in a bed of chalk mixed with a thick blue clay, exactly the shape of her body below that draught of water; and from the rudder being torn off as the ship coming on shore, and the violent agitation of the sea after her being there, her stern was so greatly injured as to admit free access thereto, which filled her four days equal to the flow of the tide. Having fully informed myself of her situation and the flow of spring-tides, and being clearly of opinion she might be again got off, I recommended, as the first necessary rep, the immediate discharge of the cargo; and in the progress of that business, I found the tide always flowed to the same height on the ship; and when the cargo was half discharged, and I knew the remaining part from the ship was to draw more than eighteen feet water, and while I was observing the water at twenty-two feet six inches by the ship's marks, she instantaneously to seventeen feet eight inches; the water and air being before excluded by her pressurie on the clay, and the atmosphere acting upon her upper part equal to fix hundred tons, which is the weight of water displaced at the difference of those two draughts of water.

"The moment the ship lifted, I discovered she had received more damage than was at first apprehended, her leaks being such as filled her from four to eighteen feet water in an hour and a half. As nothing effectual was to be expected from pumping, several cuttles or holes in the ship's sides were made, and valves fixed thereto, to draw off the water at the lowest ebb of the tide, to facilitate the discharge of the remaining part of the cargo; and, after many attempts, I succeeded in an external application of sheep-skins sewed on a fail, and thrust under the bottom, to stop the body of water from rushing so furiously into the ship. This business being effected, moderate pumping enabled us to keep the ship to about fix feet water at low water, and by a vigorous effort we could bring the ship so light, as (when the cargo should be all discharged) to be easily removed into deeper water. But as the external application might be disturbed by so doing, or totally removed by the agitation of the ship, it was absolutely necessary to provide some permanent se-
curiosity for the lives of those who were to navigate her to the river Thames. I then recommended, as the cheapest, quickest, and most effectual plan, to lay a deck in the hold, as low as the water could be pumped to, framed so solidly and securely, and nearly so tight, as to swim the ship independently of her own leaky bottom."

"Beams of fir-timber twelve inches square were placed in the hold, under every lower-deck beam in the ship, as low as the water would permit: these were in two pieces, for the convenience of getting them down, as also for the better fixing them of an exact length, and well bolted together when in their places. Over these were laid long Dantzic deals of two inches and a half thick, well nailed and caulked. Against the ship's sides, all fore and aft, was well nailed a piece of fir, twelve inches broad and six inches thick on the lower, and three inches on the upper edge, to prevent the deck from rising at the side. Over the deck, at every beam, was laid a cross-piece of fir-timber, six inches deep and twelve inches broad, reaching from the pillar of the hold to the ship's side, on which the shores were to be placed to refit the prefire of the water beneath. On each of these, and against the lower-deck beams, at equal distances from the side and middle of the ship, was placed an upright shore, six inches by twelve, the lower end let two inches into the cross-piece, and the upper end of every lower-deck beam, was placed a diagonal shore, six inches by twelve, to ease the ship's deck of part of the strain, by throwing it on the side. An upright shore of three inches by twelve was placed from the end of every cross-piece to the lower-deck beams at the side, and one of three inches by twelve on the midships' end of every cross-piece to the lower-deck beam, and nailed to the pillars in the hold. Two firm tight bulkheads, or partitions, were made near the extremes of the ship as possible. The ceiling or inside plank of the ship was securely caulked up to the lower deck, and the whole formed a complete floor, with a flat bottom within itself, to swim the outside leaky one; and that bottom being deprived six feet below the external water, refitted the ship's weight above it equal to five hundred and eighty-one tons, and safely conveyed her to the dry-dock at Deptford."

As to the manner in which stranding affects matters of insurance, see Risk.

Where a vessel is stranded, justifies the peace full command confinable near the sea-coast to call almsness for the poor and famine, and the officers of men of war are to be aiding and afflicting. 12 Anne, cap. 18.

**STRAND and Stream**, in *Ancient Culisse*, a freedom from all impositions upon goods or vessels by land or water.

**STRANDSOGEN**, in *Geography*, a town of Norway, in the diocese of Bergen; 8 miles E.N.E. of Stavanger.

**STRANDT, North**, one of the three islands which were inhabited by the Saxons in the days of Trollem; the other two being Bufen, N. of the mouth of the Elbe, W. of Ditzmaria, looking towards Melborn, above two miles broad and nearly three in length, and containing three or four parishes, with as many villages; and Holy island, i.e. sacred island, the most celebrated and the most frequented of the Saxon islands situated in the German ocean, not 40 miles distant from Eiderstadt, and rather farther from the mouth of the Elbe, divided into Klif and Duknen or Downs, which two parts are separated from each other by a channel deep enough for vessels of a moderate bulk, and about three-fourths of a mile broad, annexed to the crown of Denmark in 1714. North Strandt was formerly torn from South Jutland by the violence of the storm. It is situated opposite to Helium and above Eiderhade, from both which it is separated by intervals of sea. This island was formerly about twenty miles long, and in most parts seven miles broad; it contained twenty-two parishes, and was noted for its agricultural produce as well as its fish; but since the time of the Saxons it has suffered much from inundations of the sea, and there is now remaining of Nordstrand only the small parish of Felsworm, which owes its safety to the height of its situation. See Nordstrand.

**STRANGALIDES**, in *Surgery*, hard tumours in the breast from milk.

**STRANGE, Sir Robert, in Biography**, an eminent English engraver, was born in one of the Orkney islands in 1721, and placed at a proper age with a painter in Edinburgh. When the Pretender landed in Scotland, he entered into the rebel army, and after the battle of Culloden, he concealed himself for some time in the Highlands. Returning to Edinburgh, he passed over to France, and settled at Rouen, where he acquired reputation by the productions of his pencil. At Paris, whither he removed, he placed himself under the instruction of Le Bas, who excelled in engraving with what is called among artists the "dry needle." In 1751 he settled in London, and acquired the reputation of being the father of historical engraving in this country. He visited Italy in 1765, and by his admirable drawings of the capital produced in that city, recommended himself to those who were capable of duly appreciating his talents and performances to such a degree, that he was admitted a member of all the principal Italian academies, and also of that of painting in Paris. The stains of his early political errors and misconduct having been effaced, he was patronized at the English court, and in 1787 received the honour of knighthood. After a course of the most indefatigable labour in the practice of his art, he died in 1792. Besides a number of other works, he left fifty capital plates from pictures of the most celebrated masters of the Italian schools. Seckerist, as he was known to his friends, copied from eight copies of the best impressions of every plate which he engraved, he collected them into as many volumes, and prefixed to each two plates of himself, one an etching, the other a finished proof, from a drawing by I. Bap. Greuze; together with an introduction on the progress of engraving, and critical remarks on the pictures from which the engravings were taken. The force and clearness of his burin were perhaps scarcely ever surpassed, and gave a permanent value to his works. The moral character and manners of Sir R. Strange are spoken of by his biographer in the warmest terms of approbation. His whole property, acquired by honourable industry, was considerate, and bequeathed to his family. Mem. of Sir Robert Strange.

**STRANGER, in Law**, deates a person who is not privy, or party, to an act.

Thus, a stranger to a judgment, is he to whom a judgment does not belong; in which sense the word stands directly opposed to party or privy.

**STRANGERS' KEY**, in *Geography*, a small island among the Bahamas. N. lat. 26° 45', W. long. 78° 0'.

**STRANGFORD**, a port-town of the county of Down, Ireland, on the west side of the strait connecting the lough of Strangford with the Irish sea. On the opposite side of the strait is Portaferry, a flourishing town; but Strangford is properly the sea-port, being the place in which is the customhouse, and where revenue officers attend. In the reign of queen Elizabeth, a castle was maintained here for securing the quiet of the county. A ferry-boat maintains the communication between the town, which is in the barony of Lecale, and Portaferry, which is in the district called The Ards. Strangford is 80 miles N.N.E. from Dublin.
STRANGFORD Lough, formerly called Lough-Conn, in the county of Down, Ireland, is the largest fall-water lake in Ireland, covering upwards of twenty-five thousand acres. The tide flows directly up to Newtown-Ardes, at the extremity of it, and there are several pleasant and useful creeks at both sides. In some parts the water is sufficiently deep for any ship, but the entrance is a long strait, through which the tide rushes with great rapidity; and in it are some rocks, especially that hоsіl called the Bar, near the entrance, which renders it dangerous to fall into it without a favourable wind and tide. In the lough there are a great number of little islands, which maintain large herds of cattle, and great numbers of fowls and upon which immense quantities of fowl are raised. The towns of Newtown-Ardes, Killalaugh, and Cumber, on its shores, have linen markets. There is a herring-fishery on the lake, but the herrings taken in it are said to be inferior, with respect to fatness and flavour, to those taken at sea. The fishery along the neighbouring coast employs above four hundred boats. The inhabitants of the shores of the lough derive considerable emolument from making kelp, which is esteemed better than that made on the sea-shore. So industrious are they, that they draw stones from the fields and spread them on the shores, in order to make the kelp-growth being obtained from rocks and stones. The name Strangford, or Strongford, is said to have been derived from the rapidity with which the sea runs into the lake, which renders the passage from Strangford to Portaferry somewhat difficult. Young's Tour. Campbell's Polit. Surv. &c.

STRANGLES, in the Mange, is a collection of foul humours formed in the body of a young colt, which are voided by the nostrils, or by a suppuration of some glands or knots that lie between the bones of the lower jaw, and are driven before the hoofs of the horse. The false strangules happen in old horses that have not well called the strangules. See GLANDERS.

STRANGULATED HERNIA, in Surgery, a rupture, or hernia, in which the protruded visceræ suffer such a degree of pressure, that very urgent and dangerous symptoms are excited. See HERNIA.

STRANGULATIO, a word used to express that kind of suffocation which is common to women in hysterical disorders, and for the straitening of the intine in hermaphrodites.

STRANGULATORIA, in the Materia Medica, a name by which Avicennia, and some other authors, have called the darovicum, or leopard's bane.

STRANGURY, in Surgery, a difficulty and pain in making water. See URINE, Retention of.

STRANKOWITZ, in Geography, a town of Bohemia, in the circle of Prachatitz; 4 miles S. of Wodanady.

STRANRAER, a royal borough in the district of the Rhyns, and shire of Wigton, Scotland, is situate at the eastern extremity of the bay of Loch-Ryan, and has an excellent natural harbour, called the Roa; where flotillas of large busses can anchor in safety. The town is divided, nearly in the centre, by a little rivulet, over which there are several stone-bridges. Many good houses have lately been erected here, also a handsome town-hoose, and a prison. It is a port of the customs, of which all the maritime parishes of the Rhyns are members. Here is also a post-office; and a church was erected for the parish in 1785. In the town are ruins of a castle, now uninhabited, but which has been of considerable height and subsidence. The employment of the town is chiefly the coasting-trade; but some vessels are engaged in fishing. At one period, a coarse cloth, called Galloway plaiding, was much manufactured in this neighbourhood; but the American war greatly injured it. Since that event, the fame persons have engaged in the linen manufacture. Coal is imported thither from Ayr, or Irvine, by sea, and is used by the higher classes; but the chief fuel is turf or peat, brought from a distance of three or four miles. Stranraer is endowed with a market, and three annual fairs; and, in conjunction with the boroughs of New Galloway, White-horn, and Wigtown, sends one member to parliament: it has also separate jurisdiction, and its municipal government is conducted by a provost, two bailies, a dean of guild, and fifteen counselling. The population of this place, in the return of 1811, was estimated at 153 in 1813; and the accounts, who occupied 287 houses.—Carlile's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, vol. ii.

STRAP, among Surgeons, a fort of band used to stretch out limbs in the setting of broken or disjointed bones. See BANDAGE.

STRAP, or Strap, in Rigging, a wreath of rope spliced round blocks, or used to encircle a yard, or any large rope, by which tackles, &c. may be connected to them.

STRAP, in Rope-making, is composed of a number of yarns plaited together with an eye at one end, to put a Rick through; it is hanked up being obtained from rocks and stones. The name Strangford, or Strongford, is said to have been derived from the rapidity with which the sea runs into the lake, which renders the passage from Strangford to Portaferry somewhat difficult. Young's Tour. Campbell's Polit. Surv. &c.

STRAPADO, or Strappado, a kind of military punishment, in which the criminal's hands being tied behind his back, a hoop is hoisted up on top of a long piece of wood, and let fall again almost to the ground; he being afterwards hoisted on the hoop, his arms are dislocated. Sometimes he is to undergo three strapados, or more.

The word is formed from the French strapede, which signifies the same, and which is supposed to come from the old verb straper, to break, extirpate; or from the Italian strappada, of the verb strappare, to wrest by force.

STRAPAZINO, in Ornithology, the name of a bird of the wheat-ear kind, with a white rump and tail, and of a dull-brown-yellow color on the head and neck; its underparts are variegated with black and yellow, and its back is longer, and of a brownish-yellow color; throat, breast, and belly, of a yellowish-white. It is common in Italy, and is frequently brought to market among the small birds. Bellonius de Avibus.

STRAPPING POSTA, are polls placed near the locks, round which the boatsmen wind their rope, and check the velocity of the boat's motion before it enters the lock, and thus prevent damage.

STRASALDO, in Geography, a town of Italy, in Friuli; 2 miles E. of Palma la Nova.

STRASBERG, a town and lordship of Germany, belonging to the abbey of Buchau; 19 miles W. of Buchau.

STRASBURG, a city of France, and capital of the department of the Lower Rhine. The place, according to some statements, contains 49,056, and the canton 49,056 inhabitants, on a territory of 70 kilometres, in one commune; but others say it has 40,000 houses, and 60,000 inhabitants. This city is situated at the confluence of the Ill and the Bruich, about a mile from the left bank of the Rhine. Before the town, on the road of Alsace, and at the end of the capitol of Alzé, and the fee of a bishop, who was a prince of the empire. Its name, which it received about the 14th century, denotes the
the “town of the street,” because it lay on the high road from France to Germany. It is well fortified with a citadel by Vauban, the outworks of which reach almost to the Rhine. It has six gates, and 200 streets, mostly narrow; eight bridges across the Ill, and one of wood, 3900 feet in length, over the Rhine, supported by an island in the middle, on which is a strong castle. A canal is made from the Bruch to the Rhine, and by means of a sluice the country may be inundated to the distance of 1500 toises. The cathedral is a beautiful Gothic structure, founded in the year 1015, and finished in 1275; the fleche, built 165 years after the cathedral, is 115 feet high, wrought in the form of a pyramid, combining solidity with delicacy. The clock, constructed on the plan of a celebrated mathematician, named Dafypodius, but now decayed, exhibits the motions of the planets, as well as the hours of the day. This city was formerly imperial; but in the year 1683, it was taken by Louis XIV., and yielded to him by the peace of Ryswick; who, however, granted to the inhabitants all their privileges and immunities which, on war, they were not to pay anything to the king, but all the imports were to be expended in the support of the city. Strasbourg has an university, governed by twenty professors, who are Lutherans, and another of Roman Catholics. The public magazines are filled every year, and the poor are carefully supplied by the magistrates. The military hospital is a handsome building, and the city infirmary will receive 800 patients of both sexes, without distinction of religious opinions; besides which, there are two houses of orphans, a foundling hospital, and a hospital for venereal complaints, a lazaretto for epidemic diseases, a house of charity for mendicants, an anatomical hall and cabinet, a botanical garden, a public library, a military school, &c. Before its union with France, the Lutherans only exercised public employments; after that the Catholics were admitted to a share. From its situation, Strasbourg is a place of considerable commerce; here are manufactures of tobacco, china, steel, lace, carpets, cloth, leather, &c. The revenues are paid to amount annually to the sum of a million of livres; and in the year 1767, a plan was formed to embellish the city, coupled with the regularization of streets, and building houses in a state of uniformity. The Lutherans have seven churches, in one of which a most beautiful mausoleum of white marble was erected to the memory of the great Archduke Saxo, in the year 1777. The chapter of the cathedral was founded in the year 1015, to be composed of 24 nobles of the rank of counts. The episcopal territory beyond the Rhine was, in 1801, given to the marquis of Baden; 75 poils E. of Paris. N. lat. 48° 35', E. long. 7° 45'.

Strasburg, a town of Polish Prussia, in the territory of Culin, on the right side of the Drabnitza; 30 miles N. of Thorn.—Allo, a town of the duchy of Carinthia, on the Gurck; 12 miles N. of Clagenfurt.—Allo, a town of the Ucker Mark of Brandenburg; 12 miles N. of Prenzlau. N. lat. 53° 31', E. long. 13° 44'.—Allo, a town of Bohemia, in the circle of Bohemia; 12 miles N.N.W. of Jung-Buntzel.—Allo, a town of Welfphalia, in the county of Stolberg; 4 miles E.N.E. of Stolberg.

Strasbourg, a post-town of Virginia, in Shenandoah county, on the N.W. branch of the north fork of Shenandoah river, containing a handsome German Lutheran church, and 60 or 70 houses; 77 miles N.E. by N. of Staunton.—Allo, a township of Lancaster county, Pennsylvania, situated on an eminence, in the centre of a fertile and well cultivated country, containing 2710 inhabitants; 8 miles E. of Lancaster.—Allo, a settlement of Kentucky; near the Bullit Lick.

Straschnitz, a town of Bohemia, in the circle of Boleflau; 2 miles N. of Melnik.

Straseburg, or Staretz, a town of the duchy of Stiria; 11 miles N. of Marburg.

Stratis, or Stasites, a stone described by the writers of the middle ages, and famed for its medicinal virtue of promoting venery, afflicting digestion, and the like, and that whether taken inwardly, or outwardly, it is not easy, from the accounts they have left us, to guess what stone they mean.

Strasko, in Geography, a town of Moravia, in the circle of Brunn; 24 miles N.W. of Brunn.

Strasnitza, a town of Moravia, in the circle of Hraditch; 14 miles S.S.E. of Hraditch.

Strass, a town of Austria; 2 miles N.E. of Meinflau.

Strassau, a town of the archbishopric of Salzburg; 10 miles N.N.E. of Salzburg.

Strata, in Antic Geography, a country of Asia, in Syria, north of Palmyra, and near it.

Strata, in Geography, plural, (sing. stratum, Latin). A stratum properly denotes a bed or layer of stone, or mineral matter, the length and breadth of which greatly exceed the thickness. Geologists at present commonly use the plural term, strata, in a more limited sense when describing the structure of a rock or mountain: if it be formed of very thick masses of different kinds of stone, as lime-stone, slate, &c.; it is said to be composed of beds; and if any of these beds are divided into smaller layers, by seams running parallel with their upper and lower surface, the smaller layers are called strata, and the bed is said to be stratified. This distinction is merely made for the convenience of description, as we could not, with propriety, say a stratum was stratified.

Where a series of layers, or beds of different substances, as coal, sand-stone, and shale, cover each other, if the beds do not exceed a few yards in thickness, they are called strata; and the hill or mountain composed of such layers, is also said to have a stratified structure. The German geologists would restrict the term to homogeneous beds of rock which are subdivided into parallel layers; but for this limitation there does not appear any sufficient reason. Those hills or mountains which are composed of alternate parallel layers, or strata of different substances, are as truly stratified, as those which contain strata of one kind of stone only. The structure of the globe, as far as we are acquainted with it from the intertectures made by rivers, by the action of the sea upon the coast, and by mining operations, consists of a succession of beds of different kinds of stone, which generally increase in thickness as we descend deeper. The upper beds are commonly distinctly stratified; but in the lowest beds, all traces of stratification are generally lost; indeed their thickness is often so great, as to prevent our seeing the upper and under surface in any one place; and the seams or partings run in such various directions, as to preclude us from obtaining a knowledge of their structure. In various parts of the world, the lower beds appear to have been elevated and pulfed through the upper strata, forming lofty mountains and chains of mountains, on the summits of which the upper strata lie in an inclined position. And even at a considerable distance from large ranges of mountains, the strata rise in the direction towards them. On the eastern side of England the strata rise towards the mountains on the south-west, as we shall again have occasion to notice in describing the strata of England.
By the rise or inclination of the strata, and by the inequalities of the earth's surface, we obtain a knowledge of the nature and succession of the different beds to a far greater depth than it is possible to reach by sinking mines. Let us suppose a series of strata covering each other to the depth of two miles; if their position were horizontal, the lower strata would be inaccessible to our research, as few mines have been sunk to one-fourth of that depth; but if the whole series rises in one direction, the lower strata will come to the surface somewhere in that direction. See Plate II. Geology, fig. 1, where the letters a, b, c, d, e, represent different strata covering each other in an inclined position, and rising to the surface in succession, the lower stratum, e, forming the most elevated part of the series at f.

Stratification, in its simplest form, may be conceived, by placing a closed book with the back resting upon the table, and raising the opposite edges a little; the book may represent a thick mineral bed, and the leaves a series of strata. A line drawn from the upper edges to the back will be the dip of the strata, and its angle with the table the angle of inclination. Another line, drawn any where parallel to the back, and at right angles with the dip, will represent what is called the line of bearing, or level of a stratum. As every stratum rises to some part of the horizon, and dips to the opposite part, it is evident that the edge or top of such stratum, if unbroken, will come to the surface somewhere, and will be visible, if not hid by soil or loose materials subsequently thrown over it. (See Plate II. Geology, fig. 1. a, b, c, d, e.) The part of a stratum which rises to the surface, is called by miners its outcrop, or baffle; and this baffle or edge of a stratum, may not unfrequently be traced over a considerable district. Though stratification, in its more simple forms, may be easily conceived; yet in nature we frequently find the strata much broken, and thrown out of the original position by large fissures, filled with mineral matter of a different nature from the rock which they intersect. These fissures, called dykes or faults, throw down the strata on one side several hundred feet, or, what is the same thing, elevate them on the other side; and in such instances, a whole series of strata that may exist on one side of the fault, will be entirely wanting on the other side, and yet no trace of this disturbance may be visible on the surface. When a district is thus broken by faults, and intersected by valleys cutting the strata in different directions, it becomes exceedingly difficult to trace their true position, or to form a distinct notion of their arrangement from what appears on the surface. We shall explain some of the difficulties which oppose our knowledge of the true position of the strata. Let us suppose a section to be made by a river-courbe, or any other caufe, in a stratified mountain (Plate II. Geology, fig. 2.) if the section run parallel with the line of bearing of the strata, and no other part of the series be exposed to view at the station a, the strata will appear to be perfectly horizontal, and would be described as such by a superficial observer. Another section, made at right angles with the line of bearing, would show to the spectator placed at b, the true angle of inclination which the strata make with the horizontal level. Any intermediate section formed between the lines G and E, would give an inaccurate view of the true inclination of the strata; and as it can very rarely occur that the section is in the exact line of the dip, all descriptions of the inclination of strata, which have not been corrected by a series of observations, are liable to much error.

When the strata are bent or broken by faults, and an excavation is made by a river laying bare the baffle edges, the same stratum may be brought to the surface in various parts of its course, and with various apparent angles of inclination. Mr. Farey, in the 1st vol. of his Report of Derbyshire, has given a series of diagrams, representing a great variety of forms in which the strata may present themselves to the surface when intersected by faults. Thence the student of mineral geography would do well to consult, but they do not admit of abridgment.

Even where the strata are unbroken, and rise regularly, the inexperienced observer may not unfrequently mistake their true position. See Plate II. fig. 6, which represents the baffle edges or out-crops of the lower strata, rising from under the upper strata at see, and forming elevated ridges. If the surface is covered with soil or vegetation, the rock may be only visible in wet places, as at the quarry a below, and at the summit of the hill near f; if the stratum at a be of sandstone, for instance, and the rock at f granite, he may mistake the true position, and describe the granite as being incumbent on the sandstone. This is one of the errors which young geologists, as Saufure observes, most frequently commit.

The inclination of strata is seldom perfectly conformable to the curvature of the surface formed by hills and valleys, but is often in an opposite direction. (See Plate II. fig. 5.)

In this section, it may be observed that the stratum a forms a high ridge on one side of the valley, and forms also the summit of the hill on the opposite side. Incidences of this kind not unfrequently occur.

The strata sometimes take a waving course, rising with the surface of the hills on one side, and declining with them on the other. See Plate II. fig. 3.

Besides the regular rise of the strata in one particular direction, they have often small undulations and inequalities, owing to some cause which operated in their original formation. If they were now laid in an horizontal position, they would not be perfectly flat; but would present an undulating surface when viewed on a large scale.

Sometimes, instead of rising towards the summit of a hill, the strata are depressed towards the centre, forming a series of basin-shaped concavities, placed one within the other, as represented in Plate II. fig. 4, each stratum having the form of a shallow inverted cone or trough, the edges of which may be traced all round the mountain. The strata in the hill of St. Gilles, near Liege, are inclined in this position: the height of the hill is three thousand two hundred feet; it contains sixty-one beds of coal, alternating with other strata. The coal strata in various parts of England take a similar form.

In some situations, we find a series of strata lying in a position nearly horizontal, and covering beds or strata of a lower rock, which are considerably inclined, or which present great inequalities of surface, as represented in Plate II. fig. 7. The strata round Paris, which are supposed to be of fresh-water formation, rest in this manner upon the chalk. The latter rock, in various situations, is seen rising through the upper strata, as represented at a. Where a series of strata are level horizontally, other strata that are inclined, the upper are evidently of later formation, as the lower beds must have acquired their present angle of elevation before they were covered by horizontal strata.

Where a series of strata are nearly horizontal, and extend over a considerable district, intersected by deep valleys, the same stratum will make its appearance at nearly the same level in distant mountains. There is a striking instance of this in the vicinity of Pittsburgh, in Pennsylvania; a thick stratum of coal, we are informed, may be traced through many of the
the hills, at the same height above the valleys. (See Plate III. fig. 3.) a b c d represent the position of the coal stratum; in this situation, coal may be worked round the hills on all sides, by levels open to the day, and procured with little trouble. Owing to the horizontal position of the coal, it forms the bed of a river-course for several miles. Though these strata are nearly horizontal, they decline a little to the centre of the hills, as represented in Plate II. fig. 4. Hills in which the original continuity of the strata may be fo distinctly traced, by observing their identity on the opposite sides of valleys on the same level, serve as monuments to mark the progress of disintegration caused by rivers and torrents; for there is no doubt that these valleys have been excavated by the water-courses that flow through them.

Where the strata on opposite sides of a valley incline in different directions, some sudden disruption has in all probability opened a passage for the water, and aftiffed in the original formation of valleys.

In situations where regular parallel strata rise at a considerable angle of elevation, resting on unfretated elevated rocks (see Plate II. fig. 6.), it is reasonable to believe that the lower rock, c, has been forced up after the strata a b c were deposited, and that they were elevated with it.

The distribution of the spoil may appear to be of two kinds, the one in which the strata have been raised in a vertical direction, the other in which this vertical motion has been combined with a lateral motion, whereby they have been crushed, and in some instances folded over each other. The most common of these dislocations is the vertical one, as represented at fig. 8. Where a series of strata on one side of the fault have been elevated, or, what is the same, where the strata on the other side have been depressed; the corresponding strata on each side will flow the extent of the elevation or depression. Where the angle of inclination of the strata is greatly changed by a fault (as represented fig. 7), a lateral motion has been combined with the vertical one, or the pressure has been confined to particular parts of the strata. In some instances, a whole series of strata have been heaved out of their original position, and overturned, whereby the uppermost strata now occupy the lowest part of the series. In some instances, this heaving has been more entirely vertical, and declining to opposite parts of the horizon, their position nearly resembling that of the rocks of a flank spread open. A remark of this kind, in the Isle of Wight, will be subsequently noticed. Similar phenomena are noticed in the schistose mountains of Switzerland; but in those mountains, it may perhaps be regarded as the effect of crystallization on a grand scale, rather than an arrangement of strata, as these rocks are not regularly stratified.

Where the strata suddenly take a vertical position, or where they are broken in a zigzag form, as represented in Plate II. fig. 9. a b c d, we may infer that they have been compressed by a force acting in a horizontal direction, or laterally. In some of our coal mines, this zigzag position of the strata is occasionally observed; and at Akin, near Valenciennes, there is a remarkable instance of this derivation of the coal strata, nearly similar to fig. 9, in which the same letters represent the same strata as are shown on the opposite sides of the coal strata, nearly similar to fig. 9, in which the same letters represent the same strata as are shown on the opposite sides of the coal strata. The whole are covered with horizontal strata of chalk, marl, and clay, deposited at a subaqueous period.

That considerable portions of the earth's surface have not only been raised or depressed, but also moved in a horizontal direction, is made still more evident by the horizontal displacement of metallic and other veins. (See Varina, Metallic and Mineral.) Fig. 10. represents the general plan of a vein, a, running from west to east, until its continuity is broken by a river, or cleft course, which has thrown the vein several fathoms northward. Now it is obvious that the ground on one or both sides of the river course must have been carried north or south along with the vein. Nor are instances of such a lateral motion of the earth unfrequent during violent earthquakes.

The Extent of Strata.—That many of the strata extend over large tracts of country, is a fact sufficiently established by observation; but it appears to have been known but very recently. Among the miners in the coal districts it had indeed been observed, that the same beds of coal might frequently be traced to a considerable distance, until they came to the surface, and, in the miners' language, cropped out: but with respect to other strata of sandstone and lime-stone, etc., though a considerable similarity might be observed between the stone of different districts, it was not generally suspected that they were parts of one continuous stratum. The method of identifying a stratum by the fossils it contains, and by its connection with the upper and lower strata, is a discovery of the present age.

If each stratum preserved the same level where it rises to the surface, there would be no difficulty in tracing it in different districts; but from the curvatures and faults already explained, it frequently happens that a stratum, by its appearance, may be completely covered for many miles, and by some sudden break be brought to the surface again, at a much greater elevation, or may be found in sinking shafts in mines at a considerable depth. Before the means of identifying strata had been ascertained, it was impossible to obtain a knowledge of the mineral geography of an extensive district. Even with our present knowledge, it is frequently difficult to ascertain with precision the identity of strata in different countries, except those which are well characterized by fossils remains, or by some remarkable peculiarity of structure or composition.

The extent of strata is more limited in the line of their inclination, or dip, than in what is called the line of bearing, and would be still more contracted in that direction, were they not frequently thrown down by faults. We can make this more intelligible by referring to Plate III. fig. 2, which represents a section of the great stratum of argillaceous limestone called lias, which rises from the level of the sea, near Bridport, in Dorsetshire, and extends by Lyme to the river Aa, where it terminates: in this form, covered with a bed of green limestone, it is said, that a similar bed may be traced through France to the Pyrenees; but though the composition and external character are nearly the same, it may be proper to observe, that there is a considerable difference in the fossils of the English and French lias.

When the strata descend in the line of their dip or inclination, to what extent they may stretch under the surface in that direction is unknown, but in all probability they do not continue to descend very far at the same angle, but are bent in an opposite direction, and terminate at a distance more or less remote. The coal strata, as before described, often present this curvature; after descending to a certain depth, they
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Of rife to the opposite point of the horizon, forming basin-shaped concavities, as represented in Plate II. fig. 4.

The upper strata above the coal formation are arranged in a similar manner in numerous instances; but as they are never excavated by mines, like the coal strata, their position has been little attended to, after their disappearance below the surface.

It is frequently observed, that in a series of contiguous strata, there is often that general semblance and connection, which implies a natural relation; hence such strata are classed together, and are described as one formation. "We may conceive one flab of stone to be composed of different laminae, which, though not exactly of the same nature, either with respect to colour, consistence, or substance, yet all contribute to the formation of the same flab; the individual characters of which are easily recognized by their united semblance." Geological Essay by Dr. Kidd.

Thus we may conceive the chalk formation to include beds that are not chalk, but which generally accompany it; and the same with respect to the formations of lias, sandstone, slate, &c.

The German geologists assert, that the principal rock formations are universal, meaning that the spread over the whole of the earth's surface, encircling it like the coat of an onion, and this universality they contend for, both in the lower unstratified, as well as the upper stratified rocks. This opinion does not appear warranted by facts; for though the lower beds of rock, such as granite, slate, &c., have a considerable sameness in different countries, yet there is often great diversity both in their nature and the order of their succession. And with respect to the upper stratified rocks, we believe that in no two different parts of the world which have yet been examined, do the same series regularly occur. According to the observations of Humboldt, chalk and roe-stone, which occupy a considerable space on the western side of Europe, are no where to be found in America. It is now admitted, that some series of strata are local formations, because no similar series have yet been found. On the same grounds, we might regard most of the upper stratified rocks, as local formations of greater or less extent.

All geologists are agreed, that our present continents were once covered with water. This is proved by the remains of marine animals imbedded in the strata which lie on the summits of the highest mountains. From these remains it is also evident, that the upper stratified rocks were deposited under water. Now whether the ocean retired, or the continents were raised from beneath, it is obvious that the sea must have filled the present valleys and lower parts of the continent, forming numerous lakes or inland seas; and we conceive it to be more probable, that different series of strata were deposited in each of these lakes, constituting what may be called local formations; and this will explain why we generally find different series of strata on the opposite sides of a chain of mountains. The order of succession of the different strata which are most nearly allied, and which may be regarded as constituting one formation, as well as the order of succession of the greater beds themselves, presents considerable diversity in different districts, though we do not where find the lower beds covering the upper formations. This will be better understood, by supposing a series of strata, 1, 2, 3, 4, 5, 6, 7, 8, &c., arranged as they are here numerically placed, No. 1 being the uppermost. We frequently find the strata 1 or 2, resting immediately upon the strata 7 or 8, and all the intervening strata, 3, 4, 5, 6, to be wanting; but we never find the lower strata, 7 or 8, resting upon 1 or 2, except in situations where the strata have been thrown down and overturned. Where any series of strata are wanting, a question naturally arises, have they been carried away by some sudden inundation, before the upper strata were deposited, or have they never extended to that place? In some instances, we are certain that the strata have been carried away from particular situations, as in some of the excavations which have formed valleys, in forming the strata that terminate on one side of the valley may be different from those on the opposite side; but it is exceedingly difficult to suppose, with some geologists, that the strata, which now cover but a small portion of the earth's surface, were once spread over it universally. We might ask, where have the materials been carried to and deposited? This difficulty will be removed, if we admit that each stratum has been formed in bafs or lakes of limited extent, though these bafs, in some instances perhaps, may not be less than the bafs of the present Mediterranean sea.

The subfusces of which the strata are principally composed, are argillaceous, calcareous, or siliceous earth, which are generally more or less intermixed or combined; but the calcareous and siliceous strata often contain the earths nearly pure. Siliceous earth is more abundant in the lower than in the upper strata. Argillaceous strata are often combined with saline and inflammable matter, and give rise to mineral springs. Calcareous or bituminous matter is more frequently combined with alumine or clay than with the other earths. Most of the soft argillaceous strata contain iron pyrites, from the decomposition of which, the waters springing from them are generally rendered more or less hot.

To this decomposition, and the heat which is evolved, some geologists attribute the increased temperature of warm springs. (See Temperature of the Earth and of Springs.) Others suppose volcanic fires to owe their origin to the same source. (See Volcanes.) We consider this cause as inadequate to the explanation of these awful phenomena; but it cannot be denied that we have numerous instances of pyritous strata taking fire when exposed to the air and moisture. The cliffs near Charnwood, in Dorsetshire, composed of beds of pyritous clay, took fire spontaneously at a guards in a hot dry season; they continued to emit flame at intervals for several years. Watfon's Chemical Essays, vol. i. p. 197.

A pyritous clay or shale near Whity, of a similar composition, sometimes takes fire spontaneously, when masses which fall from the cliff get moistened with sea-water.

To the partial decomposition of pyritous strata, which takes place when they are penetrated by mines and have access to air, we may ascribe the generation of carburetted hydrogen gas, that frequently occasions such tremendous explosions. See Ventilation of Mines; where we propose to give an account of the various methods that have lately been devised to prevent the fatal accidents from impure air.

Strata of clay being water-tight give rise to springs, as they arrest the water that percolates through porous strata, and convey it to other situations. The inclinations of the strata before described, with the breaks and inequalities, render the globe habitable, by distributing the waters over the surface; and a knowledge of stratification is absolutely necessary to conduct the operations of draining or watering extensive districts with success, and in the easiest manner. Hence Mr. Elkington gained such merited celebrity as a drainer. As the different strata which rise to the surface decompose, they form the materials of the soil, and according to the nature of the earths of which the strata are composed, the soils are more or less fruitful or fertile. Thus, a knowledge of the strata might frequently be of great use to
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the agriculturalist, and enable him to combine the earth of one stratum with that of another in its vicinity, to ameliorate his soil, and ensure its permanent improvement. In the selection of stone for architecture, a knowledge of the composition of strata would also be of the greatest service. See Stone for Architecture.

Organic Remains in Strata.—We have before had occasion to notice, that the strata are to a great depth generally characterized by the remains of animals or vegetables, in what is called a petrified state, the organic structure being distinctly visible, although the animal or vegetable matter is almost entirely removed, and its place generally supplied by calcareous or siliceous earth. Since the attention of geologists and naturalists has been directed to the investigation of these organic remains, it has been discovered that few, if any, are perfectly similar to those species of animals or vegetables that resemble them in the most numerous species, and even genera of animals, are discovered in some of the strata, which no longer exist upon our planet.

The important discovery, that certain animal or vegetable remains are confined to particular beds, above or below which they are rarely if ever to be found, was first, we believe, made by Mr. William Smith of Mitford, near Bath, and has since been confirmed by the observations of Cuvier and other naturalists and geologists.

These organic remains are more abundant in the upper than the lower strata; and in the lowest beds of rock which have yet been examined, no traces of organic remains have been found. Hence such beds of rock are supposed to have been formed prior to the existence of organised beings, and have received the name of primary. We may however observe, that between those strata which abound in organic remains, other strata are frequently interjected, in which no such remains occur: hence we may infer, with some probability, that the processes, by which some of the strata were consolidated, have obliterated all traces of organic existence; and the mere absence of vegetable or animal remains in a stratum is not sufficient to prove that there was not an existence at the period when it was deposited. It is, however, remarkable, that the organic remains that occur in the lowest strata in which they have been observed, are those of shellfish and zoophytes; and it is only in the upper strata that we meet with the remains of animals possessing a more complex organisation; nor do we find the remains of viviparous land quadrupeds, except in the very uppermost strata.

These organic remains, intimated at various depths, inform us that the strata were deposited over each other at dissimilar intervals of time; and likewise that each stratum in which they occur, or under which they are found, was once the uppermost stratum of the globe: for it is obvious that the different animals, whose remains are imbedded in any stratum, must have had time to grow and perish, before another stratum was deposited upon it. The existence of different species in particular strata, proves that the materials of such strata were not brought there by any sudden inundation: for this would have mixed together indiscriminately the remains of vegetables or animals. It has been well remarked by Cuvier, that the existence of these organic remains, proves that the plants and animals lived in the sea, and formed there in succession: for, without them, we have not the least evidence that they were not contemporaneous formations.

By these organic remains in the different strata, we are also made acquainted with the great changes which must have taken place in the condition of our planet in remote ages. The uppermost stratum in England, and various parts of Europe, is formed of alluvial soil. In this soil the remains of quadrupeds of vast size, such as the elephant, the rhinoceros, the tapir, the mastodon, the elk, &c. are frequently found. Many of these are different from any existing species. These remains prove that dry land existed in the vicinity, and that Europe was then inhabited by species of animals at present unknown. Remains of vegetables are also found in alluvial soil; but in the calcareous rocks, on which the alluvial soil rests, we discover no remains of land animals or vegetables, but abundance of marine organic remains. At a still greater depth, in an argillaceous lime-stone called fossil, and in the beds of clay which accompany it, we meet with the bones of amphibious oviparous quadrupeds, such as the alligator, and with remains of unknown marine animals, different from those in the upper stratum; and also with a few vegetable remains. Under this stratum a series of strata occurs, composed of sand-stone, coal, &c. not less in some parts than one thousand yards in thickness: and throughout the whole of this series in England, not a vestige of animal existence can be traced, except one thin stratum containing muschel-shells; the remains in the other part of the series being exclusively vegetable.

Below this series of strata we meet with thick beds of lime-stone, in which no trace whatever of vegetable existence occurs; but we find again the remains of marine animals exclusively. These remains are generally less numerous as we descend lower; and in the lowest, beds of crystalline lime-stone are no longer discernible. That great and successive changes must have taken place in the condition of our planet, is proved by the succession of land animals, marine animals, and vegetables, at great depths under each other. The sagacious physiologist Cuvier, whose researches in comparative anatomy eminently qualified him for the investigation of these fossil remains, has given the following interesting statement of the general inferences to be drawn from them, relative to the former state of the world.

"The level parts of the earth, when penetrated to a very great depth, exhibit horizontal strata, composed of various subtilties, generally containing immeasurable marine productions. Similar strata, with the same organic remains, form the stratified hills to a great height. Sometimes the shells are so numerous, as to constitute the entire mass of the stratum; they are most frequently in such a perfect state of preservation, that even the smallest retain their most delicate parts, their sharpest ridges, and their finest and tenderest processes. They are found in elevations far above the level of the ocean, and in places where the sea could not be conveyed by any existing cause. They are not only included in loose sand, but are often imbedded in the hardest stones. Every country, every continent, every island of any size, exhibits the same phenomenon. We are, therefore, forcibly led to believe that the sea has, at one period, covered the present land: it must also have remained there for a long time, and been in a state of tranquillity; which circumstance was necessary for the formation of deposits so extensive, so thick, and containing exuviae so perfectly preserved. An accurate comparison of their contexture, and frequently even of their composition, cannot detect the slightest difference between the subtilty of these shells and the shells which still exist in the sea: they have, therefore, all come from the sea. Hence it is evident that the rains, or reversion, containing the sea, has undergone some change, either in extent or in situation, or in both. The traces of revolutions become still more apparent and decisive, when we approach nearer to the great chains of mountains. Many beds of shells are still found: some of these are even larger, and more solid. The shells are numerous, and perfectly preserved; but they are not of the same species with those which are found in the upper strata.
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Strata. The lower strata, containing these organic remains, have various degrees of inclination, and are sometimes situated vertically. They form the ridges of secondary mountains, and do not rest upon the horizontal strata of the hills at their base, but, on the contrary, dip underneath them. When we dig through the horizontal strata, in the neighborhood of the inclined strata, the latter are invariably found below. Sometimes, when the inclined strata are not too much elevated, they are surmounted by horizontal strata; the inclined strata are, therefore, more ancient than the horizontal, and, in many instances, appear to have been raised into their inclined position before the horizontal strata were placed upon them. If we institute a more detailed comparison between the various strata, and those remains of animals which they contain, we shall soon discover full more numerous differences among them, indicating a proportional number of changes in their condition. The sea has not always deposited mineral strata of the same kind. It has observed a regular succession as to the nature of its deposits: the more ancient strata are more uniform and extensive; and the more recent are more limited, and more variation is observed in them at small distances. Thus the great catastrophes, which have produced revolutions in the basin of the sea, were preceded, accompanied, and followed, by changes in the nature of the fluid, and of the substrata which it held in solution; and when the surface of the sea came to be divided by an arched series of ridges of different changes took place in every separate basin. Amidst these changes, it must have been almost impossible for the same kind of animals to continue to live; nor did they do so, in fact. The species, and even their genera, change with the strata; and although the same species occasionally recur at small distances, the shells in the lower strata have forms peculiar to themselves: they gradually disappear, and are not seen at all in the upper strata, till les in the existing seas. In our present seas, indeed, we never discover their corresponding species, and even several of their genera are not to be found. On the contrary, the shells of the lower or more recent strata resemble, as it respects the genus, theof which still exist in the sea; and in the last formed and loofest of these strata, there are some species which the eye of the most expert naturalist cannot distinguish from those which at present inhabit the ocean.

"If we examine with greater care, we shall discover among the more recent strata, or those which are nearest the surface, some in which land animals are buried under heaps of marine productions. Thus, the various catastrophes of our planet have not only confined the different parts of our continent to rise by degrees from the basin of the sea; but it has also frequently happened, that lands which had been laid dry have been again covered by water; either in consequence of these lands sinking down below the level of the sea, or of the sea being raised above the level of the land. The particular portions of the earth also, which the sea has abandoned by its last retreat, had been laid dry once before, and had supported quadrupeds, birds, plants, and all kinds of terrestrial productions; it had subsequently been inundated by the sea, which has since retired, and left the land to be occupied by its present inhabitants. The changes which have taken place in the production of the shelly strata, have not, therefore, been entirely owing to a gradual and general retreat of the waters; but to successive irruptions and retreats, the final result of which however has been an universal depression of the level of the sea. Thence irruptions and retreats of the sea have neither been slow nor gradual: most of the catastrophes which have occasioned them have been sudden: this is proved with regard to the laft of them, the traces of which are most confpicious. In the northern regions it has left the carcasses of some large quadrupeds, which the ice had arrested, and which are preferred to the present day, with their skin, their hair, and their flesh. If they had not been frozen as soon as killed, they would quickly have been decomposed by putrefaction. The breaking to pieces and overturnings of the strata, which happened in former catastrophes, showed plainly that they were sudden and violent, like the laft; and the heaps of debris which are found in various places among solid strata, demonstrate the vast agitation excited in the mafs of waters. Life, therefore, has often been disturbed on the earth by dreadful catastrophes,—catastrophes which, in the commencement, have perhaps moved to a great depth the entire crust of the globe, but which have since ascended generally, and to a smaller depth. Numberless living beings were the victims of these catastrophes; some have been destroyed by sudden inundations, others have been laid dry in consequence of the bottom of the sea being instantaneously elevated; their races have even become extinct. The strata in every part of the globe bear the impress of these great and terrible events so distinctly, that they are visible to all who are qualified to read their history in the monuments they have left behind."

In one part of the work from which we have made the above extract, Cuvier speaks of "animal and vegetable productions which belong to the land and to fresh waters," as being found "in the midst of the most ancient secondary strata." This may be true with respect to vegetable remains, which are occasionally found in some kind of slate; but we do not recollect an instance, either cited by Cuvier himself, or by any geologist of reputation, nor has any instance come within our own observation, of the remains of land animals imbedded in the "most ancient strata," though they are sometimes found in caverns. The remains of amphibious animals occur in strata below the chalk, as the lasi, which may be considered as very ancient, compared with the surrounding chalk; but we have never heard of remains of land animals in the strata subjacent to the lasi, either in the sand-flone of the coal formation, or in the alpine lime-flone. Animal remains in the caverns of the alpine lime-flone may be of very recent date, as these caverns are sometimes closed by the deposition of stalactites. See Stalactite.

It is a fact particularly delerving of notice, that no human bones or works of art have been discovered in any of the strata, or even in the uppermost alluvial ground, containing the remains of quadrupeds most nearly resembling existing species. It is true that human bones and implements of industry have occasionally been met with at great depths in mining operations; but under circumstances which satisfactorily prove, that they had been left there when mines were formerly worked in the same situation. The absence of human remains appears to indicate, that man was one of the latest inhabitants of the globe, and agrees with the orders of creation described by Moses in the book of Genesis. Public curiosity was recently excited by a fossil human skeleton brought to this country from Guadaloupe. It is imbedded in a layer of calcareous flint, composed of smooth particles of shells and coral; but on enquiry, it is found that the rock, in which this skeleton with other human bones occur, is situated on the sea-coast, below the present high-water mark, and immediately under the volcano called the Soufrière. The bones contain a part of their animal matter, and all their phosphat of lime. On the shores of the Mediterranean, and particularly in the gulf of Meffia, heaps of loofe sand become conSolidated in a few years. We are not to be surprized, therefore, that in a volcanic island like Guadaloupe,
Guadalupe, subject to violent convulsions from earthquakes and impetuous hurricanes, that human bodies should occasionally be discovered which have been covered by sand, that has subsequently become indurated.

It is not a little remarkable, that a recent formation of minute shelly sand-floite, exactly similar to that of Guadaloupe, has since been discovered on the coast of Cornwall.

From St. Ives to near Padstow, the country has been overwhelmed with sand confining of comminuted shells: in many places it is drifted into hills of 50 feet elevation. Among the Arundel papers, there is mention of an extensive parish being partly buried under driving sands in the twelfth century. It is also known by oral tradition, that whole farms have been overwhelmed at a period not very remote; and at this very day, upon the shifting of the sands, the tops of houses may be occasionally seen. This loose sand, on various parts of the coast, is becoming indurated, and pausing into a compact rock. At New Haye its hardness is so considerable, that it requires a great force to break it; and it is generally employed for building and other useful purposes. According to a paper of Dr. Paris on this subject, read before the Royal Geological Society of Cornwall, the solidification is caused by the infiltration of water impregnated with the various materials of the decomposing slates through which it flows.

"Where a stream of water passes through the sand-floite, there the process of induration is more rapid. Although the iron forms but a small portion of the different foreign substances which analyze into the composition of the sand-floite, it is probably the principal cause of its induration, a very small quantity being sufficient for the purpose."

The Cornish sand-floite contains fragments of slate; but where these are wanting, it bears so striking a similarity to the sand-floite at Guadaloupe, in which human skeletons are found, that even with a lens no difference can be perceived.

**Strata, Formation of, or Stratification.** The description of the strata we have here given, refers to those rocks denominated secondary. All geologists are agreed, that these are generally distinctly stratified; but with respect to the stratification of the lower rocks, denominated primary, much diversity of opinion has prevailed. Some geologists have asserted, that granite is the most frequently stratified, and others deny the fact. The difference is, we believe, rather founded on theory, than on an accurate observation of nature. Those geologists who contend for the occasional stratification of granite, suppose that stratification necessarily implies the aqueous formation of the rocks in which it occurs; and as this mode of formation constitutes a leading character of the Neptunian System, (see System of Geology,) wherever they have found granite or other rocks intersected by seams nearly parallel, they have described them as stratified. Parallel seams alone are no decisive proof of the aqueous mode of formation, as rocks of undoubted volcanic origin are sometimes intersected by such seams.

Globular balls of granite and basalt are also intersected by concentric parallel seams, which cannot be called stratification, if we mean the term to imply a succession of deposits spread over each other by water. In all probability, these seams are formed either by horizontal prelur, or by an internal arrangement of the particles analogous to crystallization. Some geologists, desirous of extending the process of stratification to the lower rocks, have confidently asserted, that all rocks, of what is called primitive or clay-slats, are distinctly stratified, and that the flat cleavage is always in the direction of the strata. From an extensive examination of these rocks in various districts, we have no hesitation in asserting that the reverse of this is the fact, not a single instance having come under our observation, where the flat laminae of true roof-slats were parallel with the direction of the bed of strata itself, but generally make it in an angle of 50 or 60 degrees. We have seen flake-rocks, which for several miles presented the appearance of strata; tabular masses of considerable thickness, rising at an angle of 80°, which might have been described as regular strata; but on pursuing the same, we observed the vertical tables resting upon a bed of lime-flats not more than 20 yards in thickness, and inclined at an angle of about 50° upon a lower bed of horn-flats. The lime-flats were distinctly stratified, and contained the remains of encrinites in the middle stratum. See Plate III. Geology, fig. 4.

What were supposed to be strata, were here evidently the vertical seams in a very thick bed of slate, resting upon the lime-flats at a moderate angle of elevation. It not unfrequently happens, that vertical laminae of roof-slats rest upon a bed of slate nearly horizontal; and under the horizontal slab, the laminae of the slate will be nearly vertical, the same as in the upper slate; but in all strata-rocks, the upper and lower part must have the same inclination in the same place; and where the seams run in a different direction to that of the beds, we are certain that they are not what have been called strata seams, or regular partings of the strata, but rents or fissures, either the result of crystallization or of mechanical separation. The remarkable convolutions which some of the slate-rocks in Devonshire and in Scotland present, are not the bendings of regular strata; for if so, the upper and lower beds would have nearly the same form, whereas we often find these bendings only in one part of the rock.

To what cause this waved structure in rocks may be owing, whether to a crystalline arrangement, or to pressure during the original formation, or whether produced by the action of moisture and change of temperature, is uncertain. We know that rocks and flats, after exposure to the weather, often present marks of internal configuration, that were not discernible when they were first exposed. It may not, however, be improper to state, that we have seen a piece of the Devonshire slate, which as a fragment of a flake-rock whatever; but after it had been submitted to intense heat in a furnace, it acquired a regular schistose structure, and the laminae assumed the waved form so commonly seen in the slate-rocks of Devonshire.

The German geologists have denominated the parallel stratified rocks *flaite rocks* (see Rock); and though in nature there may frequently be observed a gradation from regularly stratified to unstratified rocks, yet the structure of the upper rocks differs so much from that of the lower, that we conceive it would be better to restrict the term stratification to the former, or the flat rocks, as it is only in them that we can trace regular parallel seams or partings to any considerable extent. The partings in granite and the lower rocks, though they may be regular for a small distance, generally intersect each other in different directions, or entirely disappear in the body of the rock.

In what manner the strata were formed and consolidated we are subject to inquiry involved in much uncertainty, as we can observe no processes precisely analogous to the present time. The data which we may safely assume to guide us in this subject are as follows: The strata are not arranged over each other according to the specific gravity of the substances of which they are composed, a stratum of heavy flint being frequently placed above one that is much lighter. Hence we may infer, that the materials of the strata were not
not mechanically suspended in the same fluid, if so, the heaviest would have sunk the first, and we should find the strata arranged in the order of their respective density or weight. Neither can any regular gradation be traced in the crystalline texture of the strata; though viewed on a large scale, the lower strata may be described as being more crystalline than the upper; yet we may frequently observe a stratum, perfectly crystallized, placed both over and below other strata, in which no trace of crystallization is perceptible; hence we may also infer, that the materials of the strata were not all in a state of chemical solution at the same time. From the appearance of different organic remains over each other, we may further infer, that the strata were formed in succession at different intervals of time.

These are the principal data that we can at present safely asume. The disciples of Wares contend, that we are warranted by existing phenomena in concluding that the materials of rocks and strata were held in solution in a fluid which once covered the highest parts of the globe; that the lower beds of rock were chemically deposited in a crystalline state; that as the water retired it became agitated; and contained an intermixture of the fragments of pre-existing rocks, and thus the succeeding beds were formed partly of chemical and partly of mechanical deposits; that at this period the lower orders of marine animals were first created. As the waters retired still lower, they became more turbid, and contained a larger portion of fragments mechanically suspended, and thus the upper strata were principally mechanical depositions. Against this hypothesis, the objections which may be urged appear insurmountable. We know of no fluid which could hold all the different materials in solution of which rocks and strata are formed; and if such a fluid could be supposed to exist, it must have covered the earth to an incalculable depth, and it may be asked where has it retorted to? Nor can we conceive that a fluid holding such an immense quantity of heterogeneous materials in solution, could at the same time support animal life.

-Other geologists suppose, with Dr. Hutton, that our present rocks and strata have been formed from a pre-existing world.

By the decomposing effects of the elements, and the agency of floods and torrents, the materials of former mountains and continents have been broken down and carried into the seas, where they subside, forming different beds and strata. These have been subequently consolidated by the operation of a central fire, which they suppoese to exist countless in the earth, and to have periods of greater or less activity, determined by causes with which we are unacquainted. By the operation of this fire, the lower beds were fused under great compression, and subsequently crystallized; and by its expansive power, these beds were in many parts raised from the depths of the ocean, piercing through the upper strata, and forming the lofty mountains of our present continents. According as the strata were more or less distant from the central fire, they were more or less acted upon, and hence we find in general that the upper strata are less crystalline than the lower.

They further suppose that a similar process is taking place at present, and that the heaviest rocks are constantly wearing down, though their diminution be less perceptible than that of softer and less elevated strata; and that these fragments, in the form of sand, mud, or loose stones, are carried down by rivers and floods, and spread over the bottom of the seas, forming the materials of future strata, to replace the present, which are supposed to be in a state of confinant decay.

It is difficult to conceive how the different substances of which the strata are composed, could by this process be so distinctly separated as we frequently find them, particularly beds of coal, sandstone, clay, and shale. In the coal strata, we find many delicate vegetable productions, with the form perfectly preserved; and in the upper calcareous strata, we frequently meet with shells, having the most delicate spines, in a perfect state, which could scarcely be the case, had the strata been originally the fragments of rocks, carried by rivers and floods into the ocean. It has before been observed, that the strata are not arranged according to the specific gravity of their component parts; the heaviest stones are not the lowest; nor in a series of strata do we find the upper always less perfectly crystalline than the lower. That some of the lower rock formations have been fused and crystallized by the agency of fire, and that the same cause has broken the crust of the globe, and deformed or removed the upper strata by which they were covered, is rendered probable by present appearances in various parts of the world; but we think that the latter theory does not explain in a satisfactory manner the formation of the upper strata of rocks.

A celebrated modern mineralogist, M. Patrin, has attempted to revive the notions of Kepler, that the globe is a living body, and contains a circulating vital fluid. He goes still further, and asserts that a process of assimilation is carried on in it, the same as in animated bodies. It possesses instinct and volition even to the most elementary molecules, which attract and repel each other, according to sympathies and antipathies.

Each kind of mineral substance is capable of converting immense masses of matter into its own peculiar nature. The mountains are the respiratory organs of the globe, and the rivers its organs of secretion.

By the latter, it decomposes the water of the sea to produce volcanic eruptions. The veins in strata are canals or absefices in the mineral kingdom.

M. Patrin has supported this singular theory with much ingenuity, in various articles in the "Nouveau Dictionnaire de Géologie Naturelle." That part which relates to the vitality of the earth will probably gain but few profetlites; yet we do not consider it irrational to suppose that the earth may be the great laboratory in which the minerals on its surface were prepared. That the internal parts of our planet are not inert, is proved by the numerous active and extinct volcanoes, many of which appear to have been connected. See VOLCANO.

The variation of the magnetic needle may probably be owing to processes that take place within the earth.

Mr. Bakewell, in the second edition of his Introduction to Geology, supposes that the materials which form most of the strata, were originally dissolved or suspended in a fluid which has been thrown out of the numerous extinct volcanoes scattered over the globe. Their mouths or craters are of immense size; the crater of the ancient volcano of Teneriffe occupies ten square leagues; and the observations of numerous travellers confirm the assertion of Humboldt, that there is no active volcanic crater at all to be compared in size with those that are extinct: it cannot be doubted that the quantity of matter ejected was proportionate to the mighty openings through which it was thrown out. The only inferences we have of actual rock formations, are volcanic; beds and strata more than thirty miles in length, and of considerable breadth and thicknessi, have been spread over the surface of the globe in our own times; and according to M. Humboldt, the farther back we trace these eruptions, the greater is the similarity between the masses of lava, and
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those rocks which are considered by geologists as the most ancient.

"The enormous ancient volcanoes whose craters are many leagues in extent, had doubtless an important office to perform in nature; and it is unreasonably to believe, that the earth itself is the great laboratory and storeroom, where the materials that form its surface were prepared, and from whence they were thrown out, in an enormous, aqueous, or gelatinous state, either as melted lava, or in solution, or mechanically mixed with water in the form of mud, or in the comminuted state of powder or fand. The largest active volcanoes in South America, throw out earth intermixed with water in the state of mud, which hardens and forms the earth. The vaft fissures or rents that interfet the different rocks, may also have served for the passage of subterraneous matter rising to the surface. These are generally filled with fluids, which earth constitutes two-thirds of the crust of the globe. Calcareous or crataceous matter has also been ejected during aqueous eruptions in Sicily. Beds of lime-stone may have been formed by similar eruptions. Nor is it necessary to suppose that these aqueous eruptions were always sudden, and attended with violent convulsions; for when a passage was once opened, they may have riven slowly, and been diffused in a tranquil state; and by gradual condenfation, may have enveloped the most delicate animals or vegetables, without injuring their external forms. Long intervals of repose between these great eruptions may have allowed time for the growth and decay of animals, whose remains are found in different strata; whilst the formation of other strata may have taken place under circumstances incompatible with organic existence. The sucession of aqueous and igneous eruptions, would account for the alternation of volcanic rocks with strata of aquatic formation; and thus the two theories of Werner and Hutton may both be true to a certain extent, and agree with existing facts. However vast these operations may appear, they link into insignificance, when compared with the bulk of our planet itself. If a three-feet globe were to contain within it a fluid capable of acquiring solidity by exposure to the air, and were this fluid from time to time to exude through minute cracks or punctures, and form over different parts of the surface succedaneous coats of varnish, whose aggregate thickness was less than that of a wafer, this would be a greater change with respect to the artificial globe, than the formation of all the rocks and strata with respect to the earth; and the numerous dislocations and fractures, by subidence or other causes, are no more, in comparison to the magnitude of the earth, than the cracks or inequalities of this superficial varnish would be to a globe of that diameter."

That various agents have operated in the formation of strata and the lower rocks, is, we think, proved by the appearances they present. This is now acknowledged by some of the leading supporters of the Wernerian school of geology, who formerly contended for the aqueous formation of rocks. Professor Jameson, in a paper published in the second volume of Transactions of the Wernerian Society of Edinburgh, considers stratification as the result of a crystalline process, and the strata as forming the natural cleavage or folia of the globe, which he supposes may be a large polygonal crystal; and the angles of inclination which the strata make on a great scale, may form the planes or sides of the crystal. According to this theory, the strata are contemporaneous. The organic remains of different species of animals over each other prove, however, as has been before observed, that such strata were formed in succession at different intervals of time; and every theory which excludes time as one of its elements, must be obviously defective. That the structure of the lower rocks is the result of crystallization, and that they may have had a contemporaneous formation, has been maintained by other geologists. Though the strata containing organic remains must have been placed over each other in succession, yet their present order or conformation may according to the theory of Dr. Hutton, have been produced by the action of forces at a subsequent period, previously to which, they might form beds of sand, marle, or mud. The conformation, both of the upper and lower strata, may thus have been contemporaneous. See System of Geology.

The effects of great and long continued pressure have not, we think, been sufficiently attended to in the speculations of geologists; perhaps, also, many inexplicable processes in the mine kingdom may be effected by the electro-chemical action of the different strata themselves forming an immense natural voltaic pile.

STRATA of England. Little was known of the strata of England before the present century, nor will this appear surprising, when we consider how recently geology has been cultivated as a science. Some knowledge of stratification was essential to guide mining operations, particularly in the coal districts; and much local information existed among practical miners in different parts of England, but it was intermixed with many absurd or erroneous opinions; and whatever might be its value, it was generally lost with its proctor. So early as the year 1684, an incorrect attempt was made by Mr. Lillier to direct the attention of the public to this subject, and he suggested the plan of a coloured map of England, representing, by different colours, the characters of the rocks. "I am of opinion," he says, "that certain upper foils, if natural, infallibly produce certain minerals, and for the most part in a certain order." Phil. Tran. 1684.

This was an important step in the science of geology, had it been properly followed; for it is now ascertained, that the nature of the soil depends upon the quality of the strata which lie nearest the surface in each district.

Another gentleman, of the name of Mitchell, in a paper of the Phil. Tran. 1722, in describing the sand-beds near Woburn, in Bedfordshire, in which the fuller's-earth is dug, expresses his belief that the sand beds extend into Buckinghamshire and Oxfordshire, from appearances which he notices in the different counties. "This," he adds, "confirms what has been said of the regular disposition of the earth into strata, or layers of matter, commonly through vast tracts, and from whence I make a question, whether fuller's-earth may not probably be found in other parts of the same ridge of sand-hills, among other like matter." Here we have the suggestion of a valuable fact, since fully confirmed,—that certain minerals are peculiar to certain strata,—and where we discover the same stratum in a different district, there is rational ground for expecting the recurrence of the same minerals which it was known to contain elsewhere. In a practical view, this is the most valuable part of the science of geology: it does not appear, however, that the suggestion of Mr. Mitchell was attended to at the time. About forty years afterwards, the Rev. J. Mitchell, of Thornhill, near Wakefield in Yorkshire, published a valuable paper on earthquakes in the Phil. Tran. 1759, from which it appears that he had a correct notion of the general structure of the earth's surface, (so far as relates to the upper stratified rocks), derived probably from the observations of the coal-miners in his vicinity; but he made no attempt to elucidate the geology of England from his own observations.

Mr.
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Mr. J. Whitehurst was the first person in England who described the geology of an extensive district from actual examination. His "Inquiry into the original State and Formation of the Earth," contains a valuable account of the stratification of Derbyshire, from the coal strata to the lower mountain limestone, illustrated by numerous sections. Whatever may be thought of his speculative opinions, the work remains a monument of the author's industry and ability. He had the merit of first pointing out the manner in which geological examinations should be conducted, before the name of Werner was known either in this country, or on the continent.

Mr. J. Williams, a native of Wales, and a practical miner, published a work, entitled "The Natural History of the Mineral Kingdom," about the year 1780. The treatise contains considerable information respecting the coal strata, at that time little known.

Some short account of the geology and mineralogy of particular counties has since appeared, particularly Mr. Keir's description of the coal districts in Staffordshire, published in Dr. Plott's Staffordshire, and Dr. Townson's account of Shropshire.

Some mineralogical facts occasionally occur in the Reports of the Agricultural Society; but, in general, the mineralogy of the English counties, as given in these Reports, is exceedingly imperfect, and scarcely any notice is taken of the geology. From this remark there are some striking exceptions, particularly the report of Derbyshire, by Mr. J. Farley, and that of Cheshire, by Dr. Holland. The latter gives an excellent description of the slate district.

Mr. Farley has taken a wider range, and besides adding much information to what Mr. Whitehurst had given on the geology of Derbyshire, has extended his observations into the neighbouring counties, accompanied with an original and valuable geological map of the county of Derby, and the parts adjacent.

Some papers on the geology of particular parts of England, have appeared in the Transactions of the Geological Society of London. The first map containing an outline of the geology of England, was, we believe, published by Mr. Bakewell in 1813, accompanied with a description of the more important features of the mineral geography of South Britain. He divides England and Wales into three districts: the alpine district ranging along the western side, the low district on the eastern side, and the middle district lying between the alpine and the low districts.

As the rocks and minerals in each of these districts, when viewed on a large scale, differ sufficiently to warrant this division, we shall, for the sake of perspicuity, adopt it in our description of the strata of England.

The low district of England is marked on the map by a line which extends from the south-west of Dorsetshire in a waving direction to near Bath, and from thence a little east of Leicester and Nottingham, towards Doncaster and Tadcaster, and passing north of York, terminates near Scarborough. All that part of England to the eastward of this line is particularly characterized by the absence of any regular beds of coal, or metallic veins. This district is principally covered by thick beds of sand, clay, and gravel, chalk, roe-limestone, calcareous sandstone, and argillaceous or magnesian limestone. Few of the hills rise more than seven hundred feet above the level of the sea. Chalk may be considered as the prevailing rock, particularly on the eastern side of this district.

The stratification is more regular on the eastern than on the western side, and the general rife of the strata is to the south-west, at a small angle of elevation.

The beds in this district may be classed under four principal formations.

1. Beds covering chalk, consisting of alluvial soil, gravel, sand, and clay.

2. Chalk; consisting of soft chalk, hard chalk, and chalk-marl.

3. Green and red sand-beds, with roe-limestone or oolite. An argillaceous limestone, called lias. In the northern counties, magnesian limestone occupies the place of lias.

The three latter are separated in many places by beds of clay or sand of considerable thickness, and by occasional strata of lime-limestone. The alluvial soil, gravel, sand, and clay that cover the chalk strata, are the uppermost in the series of English strata, but they do not occur regularly. Some of them are considered as local fresh-water formations. The beds of gravel are frequently of considerable extent and depth, and consist of rounded siliceous pebbles, principally flint and chert, but sometimes containing also pebbles of Jasper, cornelian, imperfect agate, and chalcedony. The flint and chert pebbles have, in all probability, been derived from the chalk formation; and those who have observed the transition of flint and chert into perfect chalcedony, in the green sand covering the hills near Sidmouth, in Devonshire, will not think it necessary to seek for another origin for the chalcedony or agate found in the gravel-beds on the eastern side of England. The processes of siliceous infiltration appears to be going on at the present day, though we are unacquainted with the means by which it is effected. In the channels of gravel are found aggregations of siliceous nodules in a siliceous paste, forming a pudding-limestone of a compact texture, that a fracture will often take place with as much ease through the nodule, as through the substance in which it is enveloped. Some of these nodules are marked with impressions of marine animals, and are supposed to be casts. Petrified bones and large shells are sometimes found in the gravel, but generally in a mutilated state; they belong principally to the chalk and under strata, out of which they have probably been washed. Thin beds of gravel, intermixed with flinty loam and calcareous marl, form the upper covering in some parts of this district, particularly on the vale of Thames. They are remarkable for containing the remains of large quadrupeds, as the elk, the stag, the hippopotamus, and elephant.

A large collection of these bones was recently discovered in the grounds of Mr. Trimmer at New Brentford. The foils consisting of sandy loam, in which were no fossils; secondly, sandy gravel, containing small shells, and a few mutilated bones of land animals; thirdly, calcareous loam, in which were found the horns and bones of the ox and deer, with river-shells; forthwith, patches of peat earth, which contained the bones and teeth of elephants, resembling those both of the African and Asiatic elephant, with bones of the ox and teeth of the hippopotamus; fifthly, a watery gravel, resting on London clay. The latter contained wood penetrated by the teredo, with nautilus and other fossils, exclusively of marine origin. Phil. Trans. 1813. See Petrifications.

The beds immediately covering the London clay, though of recent date compared with the lower strata, were deposited under a very different condition of the globe from the present, when England and the continent of Europe were inhabited by animals no longer existing in these latitudes, and of which some of the species are every where extinct. The London clay, sometimes called the blue clay, is the bed on which the city of London stands; it is of very considerable thickness, varying from three to five hundred feet. It consists of tough blue and reddish clay, intermixed with sandy clay and sand. It abounds with beautiful fossils in particular
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ticular parts of the bed: among these, the most remarkable are nautili in high preservation, fossil crabs, with teeth and bones of fishes; but it does not contain ammonites, encrinites, or belemnites. Iron pyrites, felonite, fulphate of iron, and phosphohate of iron, are contained in the London clay; and also radiated sulphate of barytes, and sulphate of magnesia. The Highgate archway was cut through this bed.

The septaria or balls of which Parker's cement is made, are found in various parts of the London clay, and were supposed to be peculiar to it; but similar balls of argillaceous lime-foam, divided by seams of calcareous spar, occur also in other strata, and are equally useful for the preparation of cement. Many wells have been sunk in this bed of clay to a great depth. The water in the upper part of the bed is invariably impure, but on arriving at the sand under the blue clay, it commonly springs up in great abundance, and is extremely soft and pure. In many of the manufactories in the metropolis this water is now used, being purer than the Thames water.

Since the discovery, at Paris, of a local formation of marine strata, alternating with other strata supposed to be formed under fresh water, the fossils in the London clay have been examined with more attention, and are found to resemble those of the lower marine strata round Paris. The basin in which the London clay is deposited over the chalk, extends from the vale of Thames to the north-east, over the counties of Middlesex, Essex, Suffolk, and also Yarmouth. A similar bed of clay covers the chalk in the Isle of Wight, and on the south coast from near Poole in Dorsetshire, to Brighthelmstone in Sussex, extending several miles inland. In some parts of the Isle of Wight, this clay is covered with a regular series of strata, of limited extent, which do not occur in any part of England, but which nearly resemble the remarkable strata round Paris. We shall give a concise description of these at the close of this article, before the account of the Paris strata.

A bed of sand, of very variable thickness, is generally interposed between the London clay and the chalk. A stratum of silicious sand-foam, called grey wheatere, frequently occurs in this sand. The beds here described have but lately attracted the attention of geologists; being claffed with alluvial soils, they were supposed to be of very recent origin. In the Wealden system, chalk is described as the most recent formation of lime-foam, and every thing over it was scarcely deemed deserving of notice. Even of the chalk strata, and the various beds which occur between chalk and the sandstone formation, covering coal, very little was generally known before Mr. John Farey gave a short description of the upper series of the British strata, in the first volume of his Agricultural Report of Derbyshire.

Mr. Farey stated that he had derived much information from Mr. William Smith of Mitford, near Bath, where a map of the strata of England has recently been published. We shall subjoin Mr. Farey's description, beginning with the chalk on which the London clay and sand rest; to which we shall add some observations, to elucidate more fully the arrangement of the strata on the eastern side of England. Those who are deficient in tracing the course and extent of the strata minutely, we recommend to consult Mr. Smith's map before referred to. That part of it which comprises the eastern and midland counties is more particularly deserving a careful examination.

"The upper or siltish chalk is a thick stratum of soft or free chalk, with numerous layers of flint nodules, and great variety of echini and other organisied remains. The extremities of this stratum are to be found with us in the Isle of Wight, in Hampshire, and at Flamborough-Head, in Yorkshire.

"The lower or hard chalk is without flints; its beds increase in hardness near the bottom, where a white freestone is dug, as at Trottohine in Bedfordshire, and numerous other places; that brought from near Ryegate, and now revered as a stone on this stratum fouth of London, is used as a fire-stone.

"The chalk marl next succeeds, which varies much in its appearance, sometimes resembling chalk when first exposed, in other places appearing as a blue clay.

"The Aylesbury lime-foam strata, with green sand-beds, are remarkable for their large cornea ammonites, numerous horse-head muscles, entrochi, and other shells, glosopetrae, &c. Sand strata succeed, and several clays, which have no very decided character, except one of them, which contains a thin bed of dark-coloured lime-foam, almost entirely composed of small turbinated shells, called Suffolke marble, of which the slender pillars in Westminter Abbey, and most of our cathedrals, are made.

"The next characteristic stratum, owing to its forming a ridge through the country, is the Woburn sand, a thick ferruginous stratum, which, below its middle contains a stratum of fuller's-earth: this is the thickest and most pure in Aylesbury and at Hogfity-End, ten miles north-west of Woburn. The upper part of this sand is frequently cemented by the oxidized iron into car-foam, and the lower part contains fragments of filicified wood. The chalk-clay succeeds. It is generally blue, inclining to black, and is of great thickness. It has towards its top several beds of chunch, a soft chalk-like stone in appearance, whence the name. Numerous large gryphites, and small pointed belemnites, cornea ammonites, &c. are found above the chunch. The lower part frequently contains beds of bituminous slate or clay. The vale of Bedford, the fens of Cambridgeshire, Lincolnshire, and Yorkshire, are almost entirely situated upon the great plains formed by the gradual endings of the chalk-clay out of this stratum. The Bedfordshire lime-foam succeeds; it has blue clay-beds interposed, and abounds with small gryphites, and other shells. Buckingham, Stony-Stratford, Newport-Pagnel, and Bedford, stand upon this stratum.

"A thick clay succeeds, and then the rag-foam of Barnack, composed almost entirely of minute shells. It is so called, because stones were dug from hence for many of the most ancient and best-preferred churches and buildings in the eastern counties.

"The lime-foam and grey slate strata of Stonefield, Colly-Weiton, and numerous other places, next succeed; they abound with glosopetrae, and other organic remains. Below is a stratum of sand.

"The Bath free-foam strata form a most characteristic range through England, from Dorsetshire to the Humber in Yorkshire. Stamford, Ancaster, and Lincoln, are upon this stratum. The upper part is generally a white or light grey lime-foam; then the oviiformed lime-foam, or oolite of Bath, Ketton, &c. succeeds, below which is a great thickness of light yellow free-foam, which abounds with curious shells and fossils. Below this, sand with beds of clay occurs; and then the free-foam of so many hues of yellow and red, which is dug near Northampton, and numerous other places in this range.

"A great number of beds of sand and clay succeed, which admit of no precise description in a general account.

"Lias, clay, and lime-foam. This bed is of considerable thickness, forming generally a light-yellow tenacious surface; cold, and much disposed to hills, when laid down in
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in pasture. Thin flint of lime-flint, called blue lias, occur with the clay; some of these make a lime which is superior to any other that is known for sluces, locks, and other water-works, on account of its property of letting almost immediately, even under sea-water, and continuing to harden.

"Watchet and Aberhaf, on opposite sides of the Bristol channel, Southam in Warwickshire, and Barrow on Soar in Leicestershire, are particularly famed for this lime. The blue lias is remarkable, owing to the pentacrinos, the bones, scaly fish, and other fossils it produces; it remains throughout all the whole extent. It has perhaps the best marked and most important geological characters of any flint in the British series.

"In the lower part of the lias, a succession of other lime-flint flintas often occur, called white lias. The lias does not exist in one continuous range north of the Humber, though detached portions of it occasionally occur." The lias is many of the southern counties rests upon red marl or sand-flint.

We are not to conclude that all the different beds described by Mr. Farey, constantly occur under each other on the eastern side of England. In some places, many of the beds are entirely wanting; thus, in some parts of Dorsetshire, the green sand, which forms the under flint of chalk, rests immediately upon the lias, as in the vicinity of Lyme; and all the different beds of red-flint and sand-flint, are wanting. Further west in Devonshire, the same sand, with its various fossils, may be seen resting on the red marl.

This will be better understood by referring to Plate II. Geology, fig. 1, and Plate III. fig. 2. In Plate II. fig. 1, a is supposed to represent the chalk, b the green sand, c the oolite, d the lias, and e the red marl, arranged in the order in which they occur over each other, where all these formations exist; but in some situations, the flint, b, of green sand extends beyond the flint c, and covers a part of d and e. In Plate III. fig. 2, we have represented the arrangement of the strata, as they occur from the east of Bridport in Dorsetshire, to near Sidmouth in Devonshire. The green sand, b, may be seen rising from the sea; east of Bridport it is soon succeeded by the dark clay, and lias d d d, on which it rests. This flint extends beyond Lyme to the mouth of the river Axe, where it terminates at M. A little to the west of Lyme, L, the green sand is covered by chalk-rocks of limited extent, e, at Penhay. The lias which rises to the south-west is broken by numerous small faults, and is thus continued along the coast for several miles. Beyond the river Axe, at M, the flint appears to have been thrown down considerably, and another mass of chalk is brought to the level of the sea at Beer, a a, where it forms fantastic cliffs, perched with caverns. West of the village of Beer, the green sand covers the hills of red marl, without the intervention of the lias. Patches of the same bed of sand are seen resting upon the summits of some of the hills west of Exeter, covering the fame red marl, particularly on the summit of Haldon-hill; thus a formation nearly allied to the chalk is brought almost in contact with the granite of Dartmoor.

The thickness of the different formations varies considerably in different parts of their extent.

The Rev. J. Townsend, in a work entitled "The Character of Mofs indicated as an Historian," has given the result of his inquiries respecting the thicknesses of the flint from the chalk on the south coast to the coal districts of Somersetshire. The difficulty of meeting with good sections of the flint uncovered, and the varying thicknesses of each, make such calculations uncertain. They may, however, deference notice as approximations to truth.

The following is a condensed statement of his measurements.

<table>
<thead>
<tr>
<th>Soil and Alluvial Grounds of various thicknesses.</th>
<th>Feet.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalk more than</td>
<td>400</td>
</tr>
<tr>
<td>Three beds of green, grey, and red sand, with sand-flint</td>
<td>300</td>
</tr>
<tr>
<td>Clay in one situation</td>
<td>200</td>
</tr>
<tr>
<td>Upper, middle, and lower oolites, with interposed beds of other calcareous flint, sand, and clay</td>
<td>500</td>
</tr>
<tr>
<td>Blue clay</td>
<td>70</td>
</tr>
<tr>
<td>Liars</td>
<td>60</td>
</tr>
<tr>
<td>Red marl</td>
<td>180</td>
</tr>
</tbody>
</table>

On this statement, Mr. Bakewell, in his Introduction to Geology, observes, that "the chalk in some situations is nearly one thousand feet in thickness, and the flint which cover it in the Isle of Wight more than fourteen hundred feet. If, therefore, we add one thousand feet to the above estimate for the London clay-chalk, and minor flint which have been omitted, this would make the depth of the flint in the vale of Thames to the flint containing coal, about one thousand yards. If we suppose the lower flint accompanying coal to extend regularly under calcareous sand-flint and chalk-rocks, it would be an interesting inquiry to determine the accuracy of this statement; and when the coal fields in the north are exhausted, it may become an object of public concern. Nor would the expense for various complete trials in different situations exceed that of the present national expenditure for one week."

In the succession of flintas, the lower formations rise west of each other, and it is only where they are uncovered by the upper formations that they are visible.

The flint of the low district appears to have been formed subfequently to most of the great convulsions that have broken the lower flintas, and we know where meet with those dykes or veins of bafalt which intersect and disturb the flint of the coal formation. There is, however, one instance of a disturbance of the flintas above and below the chalk, as remarkable as any which occur in the lower stratified rocks. It may be seen at Alum bay, in the Isle of Wight, and has been described by Mr. Webber in the second volume of "Transact. of the Geological Society of London." The chalk and the clay incumbent upon it pass under the channel, called the Solent, from Hampshire, and rife in the middle of the lound, forming a range of hills, which extends from Culver Cliffs on the east, to the Needles on the west. The chalk flintas are here nine hundred and eighty-seven feet in thickness, the flintas above the chalk fourteen hundred and eighty-one feet; these, with about six hundred feet of lower flintas, are all thrown out of their original position, which was nearly horizontal, and are now almost vertical. That they were once nearly horizontal, may be proved by their occurring in that position a little further south, but still more satisfactorily by the flints found in one of the vertical beds of loose sand, of which there are several layers extending from the bottom to the top of the cliff. The flints have been rounded by attrition, are from an inch to eight inches in diameter, and appear to belong to the chalk. "Now it is inconceivable (says Mr. Webber) that these flints could have been originally deposited in their present position; they distinctly point out the former horizontal direction of the series; there are no signs of particular disturbance in these beds; the whole series appears, therefore, to have been moved together." The enormous force required to upheave such a mass of flintas not only through the Isle of Wight, but in Dorsetshire, must have been
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been sufficient to change the surface of the country, to form or destroy extensive lakes, and perhaps to separate England from the continent. The effects of this convulsion may be traced beyond Litworth in Dorset. This singular displacement of the upper strata is represented in Plate III. Geology, fig. 5, and will be further described at the close of the present paper.

The district described as the middle district, containing, in various parts, rock-salt, iron-stone, and coal, extends from the line above described, to the mountains on the western side of England, called by Mr. Bakewell the Alpine district, which ranges from Cumberland to Devonshire. The western boundary of the middle district cannot be so well defined as that of the low district, owing to the numerous branches from the mountains on the west, which in some parts extend into it.

The strata in the middle district are principally composed of argillaceous sand-rove, siliceous sand-rove, and shale, with beds of coal and iron-rove. In the northern and midland counties, the lowest stratum of this district is a coarse quartzose sand-rove, sometimes resting on a thick bed of argillaceous sand-rove. Few metallic veins occur in any of these strata; none of the hills rise higher than 1500 feet above the level of the sea, the highest part being the eastern moorlands of Yorkshire, formed of beds of aluminous schists, covered by a coarse sand-rove. The succession of strata in the middle district is more various than in the low district. The line in the southern counties, and the magnesian lime-rove in the northern, form the eastern boundary. The metalliciferous or mountain lime-rove forms the under stratum on the west from Northumberland to South Wales and Somersetshire. In Devonshire, almost all the strata of the middle district are wanting, and the red marl or sand-rove fills up the space from the line to the clay-rove, which rests immediately on granite. The red marl is in many parts of that county covered with the green sand of the chalk formation, very near to the granite, as at Haldon, west of Exeter.

The strata of the middle district are in some parts broken by the lower rocks of the alpine district which rise through them, as at Charnwood Forest, in Leicestershire, where a range of hills, composed of slate, schist, and porphyry, extends for about ten miles in a south-east and north-west direction, and is bounded on the eastern side by the line of the Charnwood Forest hills represent those of North Wales and Cumberland in miniature. Rocks of a similar formation range to the westward, through Warwickshire into Shropshire and Wales, though they scarcely appear above the surface. In rocks of this formation near Atherstone, beds of manganese have recently been discovered.

The mountain lime-rove of the alpine district forms hills of considerable elevation in the north of Derbyshire. It is intermixed with beds of a basaltic amygdaloid, provincially called toad-stone. The latter are by many geologists supposed to be of volcanic origin, and have a considerable resemblance to lava. In other parts of the middle district, the strata may be traced rising regularly to the south-west, from the line or magnesian lime-rove to the alpine district. An estimate of their total thickness has been taken in Derbyshire, from the magnesian lime-rove on the east, to the fourth bed of mountain lime-rove, from which it appears, that the total depth taken on a level line is 1510 yards. In the whole of this range there are 30 different beds of coal, varying in thicknesses from 6 inches to 11 feet, the total thickness of the coal being 20 yards.

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A similar admeasurement had been taken of the coal strata of Northumberland and Durham, from the magnesian lime-rove on the eastern side of the latter county, to the mountain lime-rove on the west, by Mr. Weitgarth Forster. This admeasurement comprehends the beds of mountain lime-rove, which are there intermixed with beds of quartzose sand-rove and argillaceous shale, to the sand-rove of Cumberland, which rests upon the slate of the alpine district. The strata interposed between the beds of coal are various kinds of coarse or fine-grained siliceous sand-rove, argillaceous sand-rove, and shale. The latter is provincially called slate, and the sand-roves are called sandstone. We shall give from this admeasurement the thickness of each bed of coal, and its depth from the upper stratum, supposing them to lie horizontally.

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil and strata</td>
<td>24 ft.</td>
</tr>
<tr>
<td>1st. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>2nd. Coal</td>
<td>10 ft.</td>
</tr>
<tr>
<td>3rd. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>4th. Coal</td>
<td>16 ft.</td>
</tr>
<tr>
<td>5th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>6th. Coal</td>
<td>7 ft.</td>
</tr>
<tr>
<td>7th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>8th. Coal</td>
<td>18 ft.</td>
</tr>
<tr>
<td>9th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>10th. Coal</td>
<td>9 ft.</td>
</tr>
<tr>
<td>11th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>12th. Coal</td>
<td>20 ft.</td>
</tr>
<tr>
<td>13th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>14th. Coal</td>
<td>18 ft.</td>
</tr>
<tr>
<td>15th. Coal</td>
<td>26 ft.</td>
</tr>
<tr>
<td>16th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>17th. Coal</td>
<td>10 ft.</td>
</tr>
<tr>
<td>18th. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>19th. Coal</td>
<td>14 ft.</td>
</tr>
<tr>
<td>20th. Coal</td>
<td>8 ft.</td>
</tr>
<tr>
<td>21st. Coal</td>
<td>0.56 ft.</td>
</tr>
<tr>
<td>22nd. Coal</td>
<td>10 ft.</td>
</tr>
<tr>
<td>23rd. Coal</td>
<td>14 ft.</td>
</tr>
<tr>
<td>24th. Coal</td>
<td>3 ft.</td>
</tr>
</tbody>
</table>

Various
<table>
<thead>
<tr>
<th>STRATA.</th>
<th>Yds. Ft. In.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various strata of sandstone, shale, and ironstone, with a few seams of sulphureous coal, and a thin seam of imperfect limstone called bafflelimestone.</td>
<td>284 0 0</td>
</tr>
<tr>
<td>1ft. Or little limestone</td>
<td>5 0 0</td>
</tr>
<tr>
<td>Shale, sulphureous coal, &amp; sandstone</td>
<td>24 0 0</td>
</tr>
<tr>
<td>2d. Limestone</td>
<td>21 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>3d. Limestone</td>
<td>1 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>4th. Limestone</td>
<td>28 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>2 0 0</td>
</tr>
<tr>
<td>5th. Limestone</td>
<td>10 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>6th. Limestone</td>
<td>20 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>3 0 0</td>
</tr>
<tr>
<td>7th. Limestone</td>
<td>10 0 0</td>
</tr>
<tr>
<td>Shale, sandstone, and a seam of sulphureous coal</td>
<td>14 0 0</td>
</tr>
<tr>
<td>8th. Limestone, called cockle-shell limestone</td>
<td>2 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>4 0 0</td>
</tr>
<tr>
<td>9th. Limestone</td>
<td>18 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>9 0 0</td>
</tr>
<tr>
<td>10th. Limestone called Tyne Bolton</td>
<td>9 0 0</td>
</tr>
<tr>
<td>Whinstone or basalt, thickness various, in some parts 80 yards</td>
<td>44 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>23 0 0</td>
</tr>
<tr>
<td>11th. Limestone</td>
<td>10 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>9 0 0</td>
</tr>
<tr>
<td>12th. Limestone,</td>
<td>7 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>13th. Limestone</td>
<td>30 0 0</td>
</tr>
<tr>
<td>Siliceous sandstone</td>
<td>11 0 0</td>
</tr>
<tr>
<td>14th. Limestone</td>
<td>4 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>15th. Limestone</td>
<td>7 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>7 0 0</td>
</tr>
<tr>
<td>16th. Limestone</td>
<td>8 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>4 0 0</td>
</tr>
<tr>
<td>17th. Or great limestone</td>
<td>42 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>8 0 0</td>
</tr>
<tr>
<td>18th. Limestone</td>
<td>5 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>58 0 0</td>
</tr>
<tr>
<td>19th. Limestone</td>
<td>3 0 0</td>
</tr>
<tr>
<td>Sandstone and shale</td>
<td>68 0 0</td>
</tr>
<tr>
<td>Siliceous sandstone</td>
<td>30 0 0</td>
</tr>
<tr>
<td>Black and red shale</td>
<td>16 0 0</td>
</tr>
</tbody>
</table>

Red sandstone not sunk through.

The total thickness of these strata in this estimate is about 300 yards, including the beds of mountain limestone. The total thickness of the 24 beds of coal may be taken on the average at 48 feet, of which eight beds are of sufficient thickness to be worked. There are 20 beds of limestone and one of imperfect limestone, making a total thickness of about 180 yards. The great whin stratification, or gil, as it is called, is supposed to be a regular stratification. It is exceedingly various in its thicknesses. Where it is seen on the banks of the river Tees, near Tees Force, it forms rude basaltic columns of considerable size. As the strata rise to the south-west, the different beds of coal make their appearance on the surface on the western side of Northumberland and Durham, but they are thrown down by faults, which have considerably disturbed their regularity. The arrangement and succession of the strata in this part of our island may be seen in Plate III, fig. 1, which represents a section of England taken by Mr. Baker, and copied from the second edition of his Introduction to Geology. It commences from the German ocean, where the magnesium lime-stone of the low district, A, is seen rising above the level of the sea, L.L. Proceeding west, we come upon the coal strata B B; before we reach Durham, they continue across the country to near Waddington, rising in succession to the west or south-west, but are much broken by faults. Here various beds of coarse sandstone or grit, finer crystalline sandstone, and indurated shale, succeed in the same direction: they contain a few seams of coal. Metalliferous lime-stone soon makes its appearance farther west, C C; but no where forms those immense cliffs, more than 80 or 100 yards in height, which we meet with in Craven, in Yorkshire, and in Derbyshire. Nearly the lowest bed of lime-stone is 42 yards in thickness: it extends from Melmerby Scar into Westmorland. The whole of the strata, C C, is interbedded with veins of lead and zinc, which are very productive in the great lime-stone, but produce less as they pass through the sandstone strata, and rarely produce any ore in the shale.

The highest point of the metalliferous limestone district is Croas Fell, a mountain on the western side of Durham, about three thousand feet above the level of the sea. It is composed of various beds of limestone, alternating with sandstone and shale, and is covered near the summit with the lower series of strata of the coal formation. It is intersected by a great vein of lead ore running east and west. A great fault, called the Burtruford Dyke, filled with whinstone or basalt, runs north and south, and throws down the strata to the west side of it, to the amazing depth of one hundred and sixty yards. (See X.) The strata, as they approach it, rise at an angle of about twenty-five degrees. Defending the western declivity of Croas Fell, we come to the red sandstone rock, the lowest of the beds in Mr. Forster's measurement, before given. It is marked D in the section, and extends beyond Penrith. The red sand-rock bounds the alpine district of Cumberland, marked E E. The mountains of this district surrounding the lakes of Cumberland and of Westmorland are not striated: they are composed of slate, hornstone, porphyry, greenwacke, greenstone, sienite, and granite. Beyond these mountains, on the west, we meet with stratified hill-country coal, extending to the Irish channel, marked F.

The mountains in the vicinity of the lakes contain metallic veins, and beds of copper, manganese, and lead. The strata on the western side dip towards the sea, and coals have been worked for more than a mile under the sea at Whitehaven. The pit was filled by a very high tide, which rode above the shaft, and buried the workmen and the works.

The alpine district of England is composed of these rocks, which, by the German geologists are called primary and transition rocks. (See Rocks.) In these, few traces of regular stratification can be observed, though they are frequently divided into tabular masses, which have been mistaken for strata. These rocks form the foundation on which the stratified rocks of the middle and low districts are laid. They are composed of greenwacke, lime-stone, slate or clay-slate, granite, porphyry, sienite, and greenstone. Many of them appear to be composed of an intermixture of the above rocks, and have no well-defined character.

The alpine district is composed of groups of hills and mountains, which, viewed on a grand scale, may be considered as forming one chain, extending on the western side of England and Wales from Cornwall to Cumberland, and
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from thence to the northern extremity of Scotland. It is broken into three parts by the intervention of the Bristol Channel, and the low grounds of Lancashire and Cheshire. They are denominated by Mr. Bakewell the Northern, the Cambrian, and the Devonian range.

The northern range enters Cumberland from Scotland, and passing through that county and Westmoreland, extends into Northumberland and Durham. It continues along the western side of Yorkshire and Derbyshire, and into Staffordshire.

The loftiest mountains of the Cambrian range extend through Caernarvonshire and Merionethshire; they decline in height as they pass through South Wales, and on the borders of the Bristol Channel are covered with regular stratified rocks of the coal formation, comprising an extensive coal field one hundred miles in length, and from five to twenty in breadth, ranging from Pembrokeshire into Monmouthshire.

The Devonian range commences in Somersetshire, and passes through Devonshire into Cornwall. The highest point of this range is formed by the granitic rocks of Dartmoor. Granitic rocks of less elevation range through Cornwall to the Land's End, but they are covered in many parts with slate, provincially called "killar" in Cornwall, and "shillet" in Devonshire. The slate, or shillet, in Devonshire, is covered on its eastern side by red sandstone: in many parts a red bafatic amygdaloid is interposed between the red sandstone and the slate, and may be seen rising through the former in the vicinity of Exeter. From tradition, and from prevalent appearances, it is rendered probable, that a large extent of country on the western side of Cornwall has been washed away by the fury of the Atlantic ocean, which is impelled with impetuous violence on the coast. If the granitic rocks were ever covered by stratata similar to those on the eastern side of England, they were too lofty to form the ravages of the ocean. The granite of Cornwall forms a barrier which protects the southern shores of England from the rapid encroachments of the sea, by breaking the violence of the western tides; yet the land is gradually and constantly diminishing along the line of coast from Cornwall to Kent. In the short period of a single life, this diminution is scarcely noticed, except by those whose estates adjoin the sea; but in the lapse of centuries, the outline of the country is changed, and its surface sensibly reduced. Of this, we might cite numerous instances, both on the southern and eastern coasts. Whitsby abbey, in Yorkshire, offers a striking proof: it was built, on an elevated plain, in the year 666, at which time it was more than a mile from the sea; at present it is very near the edge of a perpendicular cliff, which is continually falling down as the sea excavates the base.

FRESH-WATER STRATA.—We have before mentioned, that a series of stratata occur in the Isle of Wight, resembling the stratata in the vicinity of Paris, but which do not occur in any of the English counties. These stratata lie in a horizontal position on the northern side of the island, and are distinctly visible in a hill called Headon, adjoining the vertical stratata of chalk before described. The hill is about four hundred feet in height. The lower bed (see Plate III. Geology, fig. 3,) is of beautiful white sand, and abounds with fragments of very many shells, over which is laid a bed of dark-clay, K, and upon this a series of beds of sandy calcareous and argillaceous marls, L. Some of them, according to Mr. Webster, consist almost wholly of the fragments of fresh-water shells, as the limineous, planorbid, cycloform, and others resembling helices and mytilus. This he denounces the lower fresh-water formation. In this formation in the Paris basin, the gyppum beds are situated. Over the lower fresh-water occurs a stratata consisting of clay and marle, M, which contains a great number of shells, wholly marine. Ten of the species agree with those in the London clay. Most of them appear to have undergone but little change; and some of the species can scarcely be distinguished from recent shells. Some of the shells are very delicate, but in a high state of preservation, thus showing that they must have lived near to the spots where they are now found.

In other parts of this stratata are banks of large fossil oyster-shells, the greater part of which are locked into each other in the way in which they usually live, and many have their valves united. It is therefore evident, that these oysters have not been removed from a distance, but their present situation. The fossils are nearly allied to those in the upper marine formation in the Paris stratata.

The upper fresh-water formation rests immediately on the lower, and is the most remarkable one in the series. It occurs about half way up the hill at N, and is about forty feet in thickness. It is a calcareous bed, every part of which contains fresh-water shells in great abundance, without admixture of marine exuviae. Many of the shells are in high preservation, and the animals appear to have lived near the places where they are found, as the shells are so friable, that they could not have been removed from their native situation without being broken.

This stratata appears to have extended over the whole northern part of the Isle of Wight, but it has not yet been observed in the Paris basin, called calcaire d'eau douce. The external characters of the stone in both countries are sufficiently different from any known rock, to render them distinguishable even without the shells. Over this stratata is another bed of clay, eleven feet in thickness, containing numerous fragments of a small nondescript bivalve shell. Other calcareous stratata, containing a few fresh-water shells, succeed. The whole is surmounted by a bed of alluvium, O, forming the summit of the hill.

There is one remarkable difference between the fresh-water stratata over chalk, in the vicinity of Paris and in the Isle of Wight. In the latter, there is a total absence of fossiliferous formations, so abundant in the former. The lime-stone impregnated with fossil, and containing a burl-stone, covers half the bottom of the Paris basin. (Transactions of the Geological Society, vol. ii.) Though the shells in these stratata are considered by Mr. Webster and other naturalists as undoubted fresh-water shells, yet as they differ more or less from those of existing species, it may be asked, are we certain that animals which bear a close resemblance to fresh-water shells, might not formerly have been inhabitants of the ocean? Or might not these animals have been brought in a living state to their present situations by rivers or inundations, which emptied themselves into the sea? If we admit that they are really fresh-water shells, and the beds which cover them contain exclusively marine shells, we must also admit that the places where they are found have been successively covered with seas or lakes of salt and fresh water, after the formation of the London clay. To explain this, it is not necessary to suppose a general riming of the ocean, or an alternate subidence and elevation of the land. Lakes in the vicinity of the sea might have their barriers
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rriers broken down by earthquakes, and closed again by deposits of sand and gravel, by which the nature of the waters would be changed. If the strata in the hill of Heaton were once the bottom of a lake, one great revolution, at least in the state of this part of the globe, must since have taken place, by which level of the sea has been changed, and the surface of the land cut down and excavated, leaving no external trace of its original outline.

Strata round Paris. The geology of the country round Paris resembles, in a considerable degree, that in the vicinity of London. The capitals of both empires are situated over the same substratum of chalk, covered by a deposition of more recent strata: thus the geologist may regard the inhabitants of each as children of the same soil; and it were surely more wise to urge this as a plea for mutual amity, than to make the geographical position of the two countries a motive for eternal hatred, and exclaim with a late British senator

"Littora litoribus contraria, fluviibus undas,
Imprecor arma arma pingunt ipoque nepotes."

En. 4.

"Our clifs, our coasts, our waves opposed to theirs,
May the same fate descend to all their heirs."

Dryden.

The basin in which the upper strata round Paris are deposited is of considerable extent. The total thickness of the beds over chalk is about 700 feet. A very interesting account of these beds, and the extraordinary fossils they contain, has been published by Cuvier and Brongniart, in the "Geographie Minéralogique des Environs de Paris," from which we shall extract the particulars most deserving notice.

The country in which Paris is situated is perhaps the most remarkable that has yet been observed, both from the succession of different beds, and from the extraordinary organic remains they contain; millions of marine shells, that alternate regularly with fresh-water shells, compose the principal strata. Bones of land animals, of which the genera are entirely unknown, are found in certain parts; other bones, remarkable for their large size, and of which similar genera exist only in distant countries, are found in the upper beds. No country can afford more instruction respecting the last revolutions that terminated the formation of the present continents. Though chalk is the foundation, it rises to the surface, only a few situations being covered with other beds, in the following order:

1. Chalk with flint.
2. Phric clay and lower sand.
3. Coarse marine lime-flint, or calcaire grofsère. The place of this is sometimes occupied with the lower sand-flint, N° 4.
4. Lower marine sand-flint.
5 & 6. Lower fresh-water strata, gypteous clay and gypsum, containing bones of quadrupeds, and a bed of oysters.
7. Sand and sand-flint, without shells.
8. Upper marine sand-flint.
10. Upper fresh-water formation, with mill-flint.
11. Alluvial soil, ancient and modern, including gravel, pudding-flint, black earth (les marnes argileuses noires) and peat.

1. Chalk.—This chalk agrees in external characters with that found in other countries. It occurs in indistinct horizontal strata; in which we observe either interrupted layers, or tuberose-shaped masses of flint, which pass into the chalk at their line of junction, or kidnies of hard chalk, having the same shape and position with the flint. This formation is well characterized by the petrifactions it contains, which differ not only in the species, but sometimes also in the genus, from those that occur in the coarse lime-flint. Two species of blemnites occur in the chalk, and these appear to be different from those found in the lime-flint, and are considered to characterize it.

The chalk forms the bottom of the basin, in which are deposited the different formations that occur around Paris. Its surface must have presented numerous inequalities before the present strata were deposited over it, because we observe promontories and islands of chalk rising through the newer formations. In Plate II. Geology, fig. 7. we have given a section of a similar arrangement of the strata, a representing the chalk, b, b, b, the newer strata.

2. Phric Clay.—All around Paris we find the chalk covered with a deposit of platific or potter's clay, which is dug and used in the manufacture of different kinds of pottery. This clay varies in colour, being white, grey, yellow, red, and black; sometimes it contains a layer of sand, and very rarely a few organic remains, such as cytherea, turritellæ, and bituminous wood; they sometimes occur in the purer clay; and in some places fragments of chalk have been observed in it. It is neither intermixed with the chalk at its line of junction with it; nor is it more calcareous, where in contact with that mineral, than at a distance from it: hence Cuvier conjectures that it has been deposited after the chalk, and is therefore a late or late formation.

3. Coarse marine Lime-flint, with marine Sand-flint. This formation presents much greater variety than the chalk. Several different strata, or series of strata, such as lime-flint, clay-marle, lime-flint-marle, and flate-clay, occur in it. These are arranged in a determinate order, and the strata of lime-flint are well characterized by the petrifactions they contain; the same system of strata always possessing the same species of petrifactions.

The lowest or first series of strata of the coarse lime-flint formation is very sandy, and sometimes contains a substance resembling green earth; it is still better characterized by containing a great variety of well-preferred shells, many of which still retain a pearly lustre, and differ more from the present existing species than those in the upper strata of this formation.

The following are the petrifactions enumerated by Cuvier and Brongniart, as occurring in it:

Nummulites lavigata, Lacinia, and nummulis. These are always found in the lowest part of the bed. Madrepores, at least three species. Algae, three species. Carpophyllum, three simple and one branched species. Fungites. Cerithium giganteum. Lucia lamellosa. Cardium perulifum. Voluta cithara. Crassafilia lamellosa. Turrinita multifulca. Oftrea fibula. Oftrea cymbula. The second series of strata is still very rich in shells; nearly all the bivalves found by M. Defrance at Grignon belong to it. It also contains a few impressions of leaves and stems. The most characteristic petrifactions of this series of strata are the following: Cardita avicularia. Orbitolina plana. Turrinita imbecula. Terebellum convolutum. Calymene trochiformis. Pecten pulvinatus. Citherae nita. Citherae elegans. Milolites, very abundant. Cerithium; probably several species; but neither the apudium and petroclisium, nor cinetum and plicatum, which latter belong to the second marine formation that covers the gypsum.

The third series of strata is less abundant in petrifactions, and contains fewer species than the two preceding. The following have been observed. Milolites, very rare.
STRATA.


The strata of the second and third series sometimes contain beds of sand-flone or mafes of horn-flone, filled with marine shells. In some cases the sand-flone takes the place of the lime-flone. Land-shells and fresh-water shells (limnea et cyclostome) have been observed in this sand-flone, but only where it lies immediately under the fresh-water lime-flone. The sand-flone and horn-flone containing marine shells, rest either immediately on the marine lime-flone, or are contained in it. The following list contains the names of those species of petrifications which occur most frequently in the sand-flone. Calyptra trochiformis. Oliva laumontiana. Ancilla caesalipera. Voluta harpula. Fusis bulboformis. Cerithium ferratum. Cerithium tuberculatum. Cerithium coronatum. Cerithium lapidum. Cerithium mutable. Ampullaria acuta or spirata. Ampullaria patula. Nucula deltoida. Cardium lima. Venericardia imbricata. Cytheres nitida. Cytherea elegans. Cytherea tellinaria. Venus callosa. Lucina cirrincina. Lucina faxorum. Two species of oyster, still undetermined; the one appears allied to atherina dilata, to offera cylindrical, while the other to offera symbalicus.

The fourth forms of strata, consist of hand calcareous marle, soft calcareous marle, clayey marle, and calcareous sand, which is sometimes agglutinated, and contains horizontal layers of horn-flone, crysals of quartz, and rhomboideal crystals of calcareous spar, and small cubical crysals of fluor spar. Petrifications occur very rarely.

4. Siliceous Lime-flone, without Shells.—This formation occurs with the coarser marine lime-flone, on the same level with it, and in no instance is either above or below it. It rests immediately on the plactic clay. It consists of strata, not only of a white lime-flone, but also of a grey, compact, or fine granular lime-flone, which is penetrated in all directions with flexes, and its numerous cavities are lined with siliceous flataclites, or quartz crysals. A characteristic mark of this rock is its wanting petrifications of every kind, both of fresh water and salt water. A species of mill-flone sometimes occurs in it, which appears to be siliceous lime-flone, deprived of its calcareous ingredient by some agent unknown to us. This mill-flone must not be confounded with that which occurs in the upper beds.

5 & 6. Gypsum of the fresh fresh-water Formation.—The fresh-water formation is not entirely of gypsum, but contains also beds of clay-marle and calcareous marle. These are arranged in a determinate order, when they all occur together, which is not always the case. They lie over the coarse marine lime-flone; and the gypsum, which is the principal mass of the formation, does not occur in wide extended tables, like the lime-flone, but in finge conical, or long mafes, which are sometimes of considerable extent, but always sharply bounded. Montmarte presents the best example of the whole series of the formation, and these three beds of gypsum are to be observed superimposed on each other.

The first bed consists of alternate layers of gypsum, folia calcareous marle, and of thin platy argillaceous marle, or adhesive flate. The layers of gypsum are thin, and full of crysals of selenite; and in the clay-marle, or adhesive flate, imbedded menilite occurs. Wherever this bed rests immediately on the sand of the marine sand-flone containing the shells, it contains sea-shells. The former bottom of the sea, however, appears to have been frequently covered with a bed of white marle, on which the lower beds of gypsum rest; and this bed is filled with fresh-water shells. The second bed resembles the first, and only differs from it in being thicker, and containing fewer beds of marle. The only petrifications it contains are those of fishes. In the lower part of this bed, we for the first time meet with single kidnies of celeline, or sulphate of frontian. The third or upper bed of gypsum is by far the greatest; in several places it is more than fifty feet thick. It contains few beds of marle, and at some places, as at Montmarte, it lies almost immediately under the soil. The lower strata of this upper gypsum contains flint, which appears to be intergraded with it, and to pass into it by imperceptible gradations, facts which shew their contemporaneous formation. The middle strata of this bed split naturally into prismatic concretions, with many fides. The uppermost strata, of which five generally occur, and extend to a great distance, are thinner than the others, and are intermixed with marle, and also alternate with beds of it.

Numerous quarries are situated in this upper gypsum, which daily afford skeletons or single bones of unknown quadrupeds. To the north of Paris they are found in the gypsum itself, where they are hard, and simply covered with marle; and to the south of Paris, similar remains, but in shells and of shells, of the genera lymeaneus and planorbis, are met with. The two latter do not differ very much from those found in the marxes of France; a fact which seems to shew that this marle, as well as the subjacent gypsum, have been deposited from fresh water. In the numerous and thick beds of clayey and calcareous marle which rest upon this white friable marle, petrifications are so rare, that we cannot form any satisfactory opinion as to their formation. It is in the white friable marle that the fresh-water shells, which principally characterize this formation, are found. The first fresh-water formation neither contains mill-flone nor flint, only menilite and wood-flone. Over the beds of clayey and calcareous marle there rests a bed of yellowish flaty marle, three feet three inches thick. Kidnies of earthy celeline, or frontian, occur in the lower part of it; higher up we meet with a bed of small bivalve shells, which are referred to the genus eipheres; and between the uppermost layers of the marle, other species of eipheres, with cerites, spherites, and bones of fish, occur. This bed is not only remarkable on account of its great extent, (having been traced ten leagues in one direction, and four leagues in another, and throughout the whole being of the same degree of thickness,) but also because it marks the upper boundary of the fresh-water formation, and the beginning of a new marine formation. All the shells that occur in the marle above this bed belong to the ocean.

A great bed of greenish clayey marle, without petrifications, rests immediately over the yellowish marle, and contains geodes, kidnies, and clayey calcareous marle, and also celeline. Immediately over these follows a bed of yellow clay-
STRATA.

clay-marle, which abounds in fragments of marine bivalve shells, cerites, trochites, machites, cardites, venites, &c., and fragments of the tail of two species of ray have also been found in it.

The beds of marle which rest over these contain fossil marine shells, but only bivalves; and in the uppermost bed of calcareous marle, immediately under the clayey sand, there occur two distinct beds of oysters; of which the uppermost contains large and thick oysters, and the upper which (is sometimes separated from the under by a thin bed of white marle without shells) contains numerous small thin and brown oyster-shells. This latter bed of oysters is very thick, is divided into many layers, and is scarcely ever wanting in the hills of gypsum.

These oysters appear to have lived on the same spot where we at present find them, because they are arranged as we find them in oyster-banks in the ocean; and the greater number of them are whole, and with both valves. The formations sometimes terminate with a bed of clayey sand, in which no petrifications occur.

Such are the beds which, in general, constitute the gypsum formation. In the following table are enumerated the petrifications that belong to the gypsum, and to the marine marle which rests upon it.

**Fossil Quadrupeds in Gypsum.**

**Genus 1.** Paleotherium, or ancient wild beast. This animal is arranged, according to Cuvier,

Cl. Mammalia.

Ordo Pachydermata.

Pone tapirum et ante rhinocerotem et equum ponens—To be placed in the natural system after the tapir, and before the rhinoceros and horse.

The five species discovered in the gypsum quarries are,

1. Magnum, the size of a horse.
2. Medium, the size of a hog.
3. Cralium, the size of a hog, varying in the form of the feet.
4. Curtum, the size of a hog.
5. Minus, the size of a sheep.

It may be proper to observe, that remains of five other species of this animal have been found in different parts of France, of which one equals in size the rhinoceros.

**Genus 2.** Anoplotherium, or beast without weapons.

Inter rhinocerotem aut equum ab una et hippocotamum, suem, et camelum, ab altera parte ponendum.—To be placed between the rhinoceros and horse, on one side; and the hippopotamus, hog, and camel, on the other.

1. Commune, size of a small horse.
2. Secundarium, size of a hog.
3. Medium, size of an antelope.
4. Minus, size of a hare.
5. Minimum, very small, the jaw only discovered.

A pachydermatous animal, allied to the hog:

Canis Parisenis.

Diadelphis Parisenis.

Viverra Parisenis.

Birds, three or four species.

Reptiles. Trionix Parisenis, and another tortoise, with a species of faurius, which appears to be a crocodile.

Three or four species of fish.

Molluscous animals. Cyclostoma mammia:

In the upper white marle are palm, fragments of fishes, limnas, and pianorbes.

**Marine Formation.**

<table>
<thead>
<tr>
<th>Slaty yellow marle</th>
<th>No fish.</th>
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The shells of these petrifications are generally in a powdery state, or we have only their mould or impression.

Almost all these shells are broken, and difficult to ascertain. The two species of cerites of the marine formation, which cover the gypsum, do not appear to occur anywhere else.

The two beds of oysters are often separated from each other by snails without shells; and although we cannot say, with any certainty, whether or not the particular species here enumerated are shells that belong more to the one bed than the other; yet it cannot be doubted that the oysters of this marle do not occur in the coarse lime-stone, and that they are more nearly allied to the species at present living in our seas, than to those found in the lime-stone.

7. Sand
STRATA.

7. Sand and Sand-stone without Shells.—The first are often of considerable thickness, and are intermixed with beds of sand of the same nature; and both are often so fine, that they are used in manufactures.

8. Superior marine Sand-stone and Sand.—This varies in colour, compactness, and even in composition, being sometimes a pure friable sand-stone, sometimes intermixed with clay, and its place is occasionally occupied by a thin bed of calcareous sand filled with shells. This sand-stone contains marine shells, which approach most nearly to those species met with in the calcareous marble over the Pyrenees.

9. Mill-stone without Shells or argillaceous Sand.—This formation consists of iron-shot, clayey sand, with greenish, reddish, and whitish clay, marl, and mill-stone.

This mill-stone is quartz, containing a multitude of irregular cavities, which are traversed by silexaceous fibres, disposed somewhat like the reticular texture in bones. These cavities are sometimes lined or filled with red ochre, clay, marl, or clayey sand; and they have no communication with each other. Most of the mill-stones found near Paris are a red or yellowish tint, but the rarer and most esteemed varieties have a blueish shade of colour. The blue variety is most highly prized, because it affords the whiteest coloured flour; and a mill-stone of this kind, six feet and a half in diameter, sells at 1200 francs. We never observe in its cavities any silexaceous stalactites or crystallized quartz; and this character enables us to distinguish in hard specimens this mill-stone from that found in the silex-stone of Normandy.

It is sometimes compact. It has been analyzed by Hecht, (see the Journal des Mines, No. 22, p. 533, and appears to be almost entirely composed of silica. Another character of the mill-stone, properly so called, is the absence of all fossil, animal, and vegetable productions, whether of fresh or salt-water origin. Mill-stones are formed by cutting pieces of these stones, and joining them together, and confining the whole with an iron hoop. They are called burr-stones. All the best mill-stones used in England are formed of the French stones.

10. The upper fresh-water formation is composed of silex and lime-stone. These substances sometimes occur independently of each other; in other instances, they are intimately mixed together. The nearly pure fresh-water lime-stone is the most common; the next in frequency is the mixture of silex and lime-stone; the large masses of fresh-water silex are the rarest. The silex is sometimes a nearly pure silex; sometimes approaches to pitch-stone, or to jasper; and, lastly, it has a corroded state, when it has all the characters of true mill-stone, but is in general more compact than the mill-stone without shells.

The lime-stone of this formation is white or yellowish-grey; sometimes nearly friable, like marl or chalk; sometimes compact and solid, with a fine grain, and a conchoidal fracture. The conchoidal varieties are rather hard, but easily broken into sharp-edged fragments, somewhat like flint, so that it cannot be cut. These characters apply only to the lime-stone near Paris; for at a considerable distance, the lime-stone occurs very compact, of a greyish-brown colour, which readily cuts and polishes. The lime-stone of Mont Ablar, near Orleans, which contains bones of the palæotherium, belongs to this formation. Even the hardest varieties of this lime-stone, after exposure to the air for a time, soften; and hence it is used as a marble for manufacturing the ground. All the varieties, both hard and soft, are traversed by empty vermicular cavities, whose walls are sometimes of a pale green colour. Where the silexaceous minerals and the lime-stone are intermixed, the latter is always corroded, full of cavities, and its irregular cells are filled with calcareous marl. The essential character of this formation is, that it contains fresh-water and land shells, nearly all of which belong to genera that now live in our moraines; but it contains no marine shells, at least in such places as are distant from the subjacent marine formation. Of the shells, the potamiids, helicites, and limnocorncus, are the petrifications that most frequently characterize this second fresh-water formation: the cyclothomum mummas has never been found in it. There are also the following vegetable and other remains: dicotyledonous woody strata of trees filled with silk, stems of arundo or tibba, articulated stems resembling the thorn, pediculated ovoidal grains, canaliculate cylindrical grains, olive-shaped bodies with an irregular streaked surface. The first or lowest fresh-water formation, on the contrary, has its characteristic petrifications, but never contains potamiids or helicites. The second fresh-water formation extends for thirty leagues to the south of Paris; and a similar formation has been met with in the departments of Cher, Allier, Nièvre, Cantal, Puy-de-Dôme, Tarn, Lot, and Garonne, in the south-east of France; and, more rarely, it has been discovered in the Roman states in Tuscany, and in the vicinity of Ulm, Mayence, Silesia, and in some parts of Spain.

11. Alluvial Soil.—This appears also to be a deposit from fresh water: it consists of variously coloured sand, marl, and clay, and of mixtures of the three, coloured brown and black, with carbonaceous matter; also of rolled marls of different kinds. What particularly characterizes this alluvial soil is the occurrence of large organic remains, as trunks of trees, with bones of elephants, oxen, deer, and large mammals. Although this formation is new, in comparison with those we have just described, yet it is of high antiquity with regard to man, as its formation extends to a period not far removed from the earliest date of our history, when the earth supported vegetables and animals different from those that at present live in these or other countries of the globe. The alluvial substances around Paris occur in two different situations: they either cover the bottom of valleys, and consist of sand, loam, or peat; or they form wide extended plains of gravel and sand, which lie high above the present river-courses. It is difficult to distinguish the alluvial mud, situated at a distance from the valleys, from the fresh-water formation; and it even, in some places, seems to pass into it. It appears, however, to be older than that of the valleys.

Strata, in many respects similar to those of the Paris and London basins, also occur in other parts of Europe, but have not been accurately examined. Nor have we any correct account of the upper strata bordering the Appennines in Italy: these are known to contain, in great abundance, the fossil bones of elephants, rhinocerotes, hippopotamus, whales, chalcos, and dolphins.

A calcareous breccia occurs in many of the stratified lime-stone rocks that border the Mediterranean sea: it is not stratified, but fills up fissures and chasms. The breccia consists of fragments of lime-stone (not water-worn or rounded), intermixed with the bones of ruminating animals and land-shells, cemented together by an ochry calcareous sublimate. Most, but not all, of the bones belong to species of quadrupeds now existing in the vicinity. According to Cuvier, the bones and fragments of rock fell into the rents of the rocks successively, and became united together by the accumulation of sparrie matter. The formation of these breccias is probably recent, compared with that of the upper stratified rocks, or even the alluvial soil that contains remains of unknown animals; but it may
still be regarded as of ancient date, since nothing shows that similar breccias are formed at the present day; and those of Corsica contain fossil remains of unknown animals. In selecting fossils remains to characterise strata, we must most carefully distinguish those which are imbedded in the original rock from those which occur in fissures, or cavities, that have been subsequently closed or filled up, as the latter may sometimes be of very recent date.

Strata Scams. Those partings or divisions that run parallel with the strata are so called by some geologists, to distinguish them from the oblique or perpendicular rents by which a stratum of stone is generally divided. The perpendicular rents that run in the direction of the dip of a stratum, are provincially called *fanes*; and the crofs rents, *cutter*.

See Coal and Strata.

Stratagem, *stratagem*, formed from *stratēgos*, a chief, or command an army, a military wile, or a device in war, surprizing or deceiving an enemy.

Stratagemas, or delusions practised towards an enemy, free from perfidy either in words or actions, or frauds laid for him consistent with the rights of war, have always been acknowledged lawful, and have had often a great share in the glory of celebrated commanders; though artifices of this kind have in various instances proved unsuccess-ful. In the use of stratagemas, however, we should regard not only the faith due to an enemy, but also the rights of humanity, the introduction of which would be pernicious to mankind. Some nations, even the Romans, for a long time professed to despise every kind of artifice, surprize, or stratagem in war; and others have proceeded so far as to give notice of the time and place for giving battle. This was the practice of the ancient Gauls. (See Livy.) It is said of Achilles, that he was for fighting openly, and not of a temper to have made one of those who were shut up in the famous wooden horse, which proved fatal to the Trojans.

"Ille non includus equo, Minerva, sacra mentito, mal feriatos Troias, et letam Priami choreis. Fellaris Atalans; sed palam captis gravis, &c."

Hor. lib. iv. Odys. vi.

In this conduct there was more generosity than discretion. It would indeed be very laudable, if, as in the frenzy of duels, the only business was to display personal courage; but a war is made to defend our country, to prosecute by force what is unjustly denied us; and the ends means are also the most commendable, provided they be not unlawful and odious. (Verg. Aen. ii. v. 390.) The contempt of artifices, stratagemas, and surprizes, proceeds often, as in the case of Achilles, from a noble confidence in personal valour and strength; and it must be owned, that when an enemy may be defeated with open force, in a pitched battle, there are greater hopes of having quelled and reduced him to sue for peace, than if the advantage was owing to surprize; as Livy (lib. xiii. cap. 47,) makes those generous senators say, who did not approve of the manner of proceeding against Perseus, as not altogether finer. Therefore, when plain and open courage may secure a victory, there are occasions when it is preferable to artifice, because the advantages gained to the state are more solid and permanent.

Vattel’s Law of Nations, &c. b. iii.

The ancients dealt very much in stratagemas; the moderns wage war more openly, and on the square. Frontinus has made a collection of the ancient stratagemas of war.

Stratarchimetry, formed from *stratēgos*, army, number, and *metron*, measure, in War, the art of drawing up an army, or any part of it, in any given geometrical figure; and of expressing the number of men contained in such a figure, as they stand in array, either near hand, or at any distance assigned.

Strategus, *stratēgos*, in Antiquity, an officer among the Athenians, of which there were two chosen yearly, to command the troops on the fleet.

Plutarch says, there was one chosen from out of each tribe; but Pollux seems to say, they were chosen indiscriminately out of the people. The people themselves made the choice; and that on the last day of the year, in a place called Pyx. The two stratēgoi did not command together, but took their turns day by day; as we find from Herodotus and Cornelius Nepos. Sometimes, indeed, as when a person was found of merit vastly superior, and exceedingly famed in war, the command was given to him alone: but it was ever a rule, not to put any person in the office but whose estate was in Attica, and who had children, that there might be some hostages and securities for his conduct and fidelity.

Constantine the Great, besides many other privileges granted to the city of Athens, honoured its chief magistrate with the title of *Megas Stratēgos*, *Magnus Dux*.

Stratford, in Geography, a township of America, in Coos county, New Hampshire, on the E. bank of Connecticut river, incorporated in 1773, and containing 359 inhabitants; 48 miles above Hanover.—Allo, a pleasant poft-town of Connecticut, in Fairfield county, on the W. side of Stratford river, containing two places for public worship, and 2855 inhabitants; 14 miles S.W. of New Haven. This township, the "Cupheag" of the Indians, was settled in 1638, principally from Massachufetts.—Allo, a river formed by the junction of the Housatonic and Naugatuck. See Housatonic.

Stratford-upon-Avon, a town of Warwickshire, England, is noted, in the literary annals of Great Britain, as the birth-place of the inimitable Shakespeare; and is also poeified of considerable interest, from its local history and situation. It is a large, populous, and respectable town; but though in a manufacturing district, is neither annoyed nor benefited by manufactories of any description. The town occupies a considerable space, and is disposed in twelve principal streets, on the western bank of the river Avon; over which is a long bridge of fourteen arches. The great road from London to Birmingham passes through the northern side of the town; other turnpike-roads branch off towards Warwick, Coventry, and Alcester, and to different parts of Northamptonshire, Oxfordshire, Worcestershire, and Gloucestershire. In 1811, according to the population report, the town and parish of Stratford contained 553 houses, and 2842 inhabitants.

The existence of this town may be traced to a period as remote as three centuries anterior to the Norman conquest; at which time, a monastery existed here in the possession of the church of the Wiccians; supposed to have been founded soon after the conversion of the Saxons to the Christian faith. In the commencement of the eight century, this convent was annexed to the bishopric of Worcester; when the manor of Stratford obtained some degree of consequence, and was rated in the Norman survey at the sum of 25l. In the reign of Richard I., a charter was granted for a weekly market on Thursdays, which is still continued; this was followed by several other grants for fairs, of which there are now three annually. In the time of queen Elizabeth, this town was greatly dilapidated by fire, and in the succeeding reigns, was again in imminent danger.
danger of undergoing the same fate. These ravages, at a period when its buildings were chiefly constructed of wood, must have been in the highest degree fearful and alarming. The civil war of the 17th century, was an important period in the history of all the principal towns in Warwickshire. In 1643-5, a party of the royalists was stationed at Stratford, but were driven from the town by the superior force of the parliament's army; who destroyed one arch of the great bridge, to prevent the returning incursions of their opponents. This precaution, however, failed; the loyalists again approached Stratford, and it afterwards became the residence of the queen, Henrietta Maria, till she departed to meet Charles I. near Edgehill.

The principal buildings in this town are, the great bridge, already noticed; the church; the chapel of the Holy Cross; the town-hall; and a seat of lord Middleton. The church, which is collegiate, though the college buildings are now destroyed, is a spacious and venerable structure, dedicated to the holy Trinity; of a cruciform description, with a square tower at the intersection of the transept, of curious and early architecture, upon which is raised a stone spire. The interior consists of a nave, two aisles, a transept, and a chancel; and contains some curious and interesting relics of sculptural antiquity. On the north wall of the chancel, are the monument and bust of the great poet, a particular description of which, with his life, are inserted in a previous part of this work, under the article SHAKESPEARE. Several large monuments of the families of Combe, Clopton, &c. are also preserved in this church. Against the north wall of the lady's chapel, is one adorned with armorial ensigns, consisting of two figures in alabaster, of William Clopton, esq. in armour, and Anne, daughter of sir George Griffith, his consort; bearing on the slab, the dates of 1592 and 1596. Another monument of the same family, with alabaster figures, coloured to resemble life, is erected against the east wall of the same chapel, to the memory of George, earl of Totnes, and baron of Clopton, with his countess, bearing the dates of 1630 and 1636. The chancel contains a monumental effigy of Mr. John Combe, who is traditionally said to have been fatized by Shakspeare, in an epitaph written upon him in his life-time. From the consideration of this church, on the margin of the Avon, is it supposed by Leland, that it is built on the site of the monastery of Streeteford: and Dugdale thinks that, with the exception of the south aisle, it was erected about the time of William I. The guild of the Holy Cross is a fraternity of which, and partly religious, was established here as a public institution in the year 1569, by Giffard, bishop of Worcester, under the name of "The Hospitall of the Holy Crofs in Stratford." This fraternity had also particular municipal privileges granted them. The chapel of these brethren, excepting the chancel, was rebuilt in the latter part of the reign of Henry VII. by sir Hugh Clopton; it is a handsome structure, in the ornamental style of the age, and contains several curious paintings in fresco on its walls. Drawings have been made of these, and etchings published by Mr. Fisher, coloured after the originals. Attached to this building are a hall for the brethren of the guild, almshouses for twenty-four poor persons of both sexes, and a free grammar-school for children, natives of the borough. The guild and fraternity were dissolved at the general suppression of religious houses; but the school and almshouses are yet continued, and the guildhall is used for the meetings of the corporation.

New-Place, at one period a principal building in the town, was originally erected by sir Hugh Clopton, in the time of Henry VII.; and after passing through the family of Yorke, XXXIV.

Underhill, was, in 1597, bought by Shakspere, who first gave it the name of New-Place, which it retained till its demolition in 1759, soon after the destruction of the famous mulberry-tree. The town-hall, first erected in 1633, was a lofty edifice, built on semi-circular arches, and supported by round columns, with a cupola on the top. Above was a room, used as a magazine for arms and ammunition; which being in the year 1642 much damaged by the explosion of a barrel of gunpowder, was partly taken down in 1767, and the present building erected in the year following. This, from the circumstance of its being dedicated to Garrick's jubilee, in 1769, to the memory of Shakspeare, was then denominated Shakspeare Hall. The building is of the Tuscan order, containing a room of 60 feet in length, decorated with large paintings, particularly two, by Wilton and Gainborough, of the inimitable poet, and of Garrick, by whom they were prefixed in 1769. The outside of the hall is also ornamented with a statue of the "Warwickshire Bard," likewise given by the same celebrated character. Below the great room are the kitchens, and two dungeons, or places of confinement. The house in which the great poet was born, is partly standing in Henley-breet. It is now converted into two, although originally but one tenement; and other houses altered by modern repairs. Stratford-upon-Avon is in the parish and division of Old Stratford, and hundred of Barilew; having separate jurisdiction, and is governed by a mayor, recorder, high reeve, twelve aldermen, twelve capital burgesses, a town-clerk, and other officers.

Stratford-upon-Avon is possessed of many local advantages, and from its situation upon the great road leading from London to Holyhead, from the numerous other roads which meet at this place, and from its having a navigable river from the Severn, and a lately completed canal from hence to that of the Worscester and Birmingham, which thus opens a communication by water with the northern part of the kingdom, it may be naturally expected that Stratford will become a flourishing town.

Independently of Shakspeare, and others of no mean, though far inferior note, we find several highly respectable characters, to whom this town has given birth and name; viz. John de Stratford, archbishop of Canterbury, lord chancellor of England, and regent of the kingdom, in the reign of Edward III.; Robert de Stratford, his brother, also lord chancellor of England, and bishop of Chichester, who died in 1526; John de Stratford, bishop of London, a nephew of the above prelates, and bishop of London in the same memorable reign; men who sufficiently make a very conspicuous figure in the history of that eventful period.

It remains to be noticed, that in this town was celebrated Garrick's jubilee to the honour of Shakspeare in the year 1769, a performance which very much absorbed the public attention. It continued three days, though the incessant rains considerably obstructed the intended ceremonies, as well as those which were exhibited. Mr. Garrick was peculiarly eminent in his recital of the "Ode," which gave unbounded satisfaction.—History and Antiquities of Stratford-upon-Avon, by R. B. Wheler, 8vo. 1806. Eight engravings. Guide to Stratford-upon-Avon, by R. B. Wheler, 8vo. 1814, with a plan of the town.


ted
read about a mile on each side of the road. Till of late
years, the east side of the town was in the parish of Wolverto
on, and the west side in that of Calverton. They are now
two different parishes, denominated St. Mary Magdalen, or
the east side of Stony Stratford, and St. Giles, or the west
side. A market was originally granted for this town to the
Vereis in 1460, and in 1663, Simon Bennett, lord of the
manor of Calverton, procured a charter for a market (which
is still held on Friday), and four fairs: there are now only
three. The town has twice suffered much injury by fire;
first in the year 1730, when 53 houses were burnt down;
second in 1742, which consumed 13 houses, and the body
of the church of St. Mary Magdalen, which has never been
rebuilt. The Sunday which followed was the flung, is yet flaying.
The damage was estimated at 10,000l., towards which,
4293l. were collected by a brief, and nearly 3000l. by sub
scription. The church of St. Giles was originally built as
a chantry chapel in 1451, and was endowed in 1483. This
church (except the tower) was rebuilt in 1776, by Mr.
Hiome of Warwick. Near this structure is a neat market-
place. According to the returns under the population act
of 1811, the East side parish contained 113 houses, 520 in-
habitants; the West side parish 211 houses, 968 inhabitants;
and the total of 366 persons, occupying 321 houses.
The chief support of the town is derived from the number of
travellers who are continually passing through it: the
principal employment of the women is lace-making.

The inhabitants are divided into several religious deno
minations: the greater number are Baptists, who have a
meeting-house in the town: the Independents have a place
of worship at Potter’s Ferry, a neighbouring village. A
guild was founded in the town, in 1461, by John Eedy and
others. Here are several charitable establishments, parti-
icularly one of 70l. per annum for apprenticing poor children.
In 1676, two Sunday schools were opened, in which up-
wards of 300 children receive the rudiments of education,
under the superintendence of the minister, churchwarden,
and a committee of subscribers. At the lower end of the
town formerly stood a cross, in memory of Eleanor, queen
of Edward I., but it was destroyed in the civil wars. At
this town Richard III., then duke of Gloucester, took pos-
session of the person of the unfortunate young monarch
Edward V., who was then with his attendants at an inn.
An act for paving and lighting Stony Stratford paft in 1612.
Lytton, Mason, in his Beauties of England and Wales, vol. i.
by John Britton and E. W. Braye.

Strathford-le-Bow, a parish in the hundred of Ousillun,
and county of Middlesex, England, was formerly a part of
the parish of Stepney, but separated from it in 1720.
The name of Stratford is derived, in common with other
places so entitled, from the source of an ancient ford, on
a Roman highway. Its distinction of Bow, according to
Leland, was given on account of a bridge "arched like
unto a bow," which was built across the river Lea at a
distant period. This parish extends along the eastern banks
of the above river, whilst Hackney, Bethnal-Green, Step-
ney, and Bromley, bound it on the other side. It contains
about 456 acres of land; of which 218 are arable, and
the remainder is occupied by pastures, marshes, and nur-
series. The soil consists chiefly of clay and loam, whilst
moor, black-moor, and heath abound in the hilly parts. No account of this parish
is found previous to 1333, when it was laid waste by the
English army, after a battle near Loudon-hill. On the
south side of the river Avon, a Roman road may be traced
for several miles. Here are also some chapels dedicated
to different saints.—Carpenter’s Topographical Dictionary of

Strathbeg, a river of Scotland, in the county of
Sutherland, which runs into loch Eribol.
STR

STRATHBOGIE. See Huntley.

STRATH-BRAND, a valley of Scotland, in the county of Perth, W. of Dunkeld.

STRATHMORE, a river of Scotland, in the county of Sutherland, which runs into Loch Hope.

STRATHNAVER, a district of Scotland, in the N.E. part of Sutherland.

STRATHY, a river of Scotland, in the county of Sutherland, which runs into the North Sea; 3 miles S.E. of Strathy Head.

STRAY HEAD, a cape of Scotland, on the N. coast of the county of Sutherland; 31 miles E. of Cape Wrath. N. lat. 58° 39'. W. long. 5° 50'.

STRATIFICATION, in Chemistry, an operation by which bodies are placed in a condition to act mutually upon each other, by being arranged layer by layer, stratum super stratum, as is practiced by metallurgists, and marked in books of chemistry with S.S.S.

STRATIFICATION, in Geology, the arrangement of mineral matter in parallel layers or beds. See STRATA.


Gen. Ch. Cal. Sheath inferior, of one leaf more or less divided, variously ribbed or keeled, permanent. Perianth superior, of one leaf, tubarum at the base; its limb in three deep, equal, erect segments, deciduous. Cor. Petals three, rounded, rather spreading to as long as the perianth. Stam. Filaments from fix to twenty, inserted into the receptacle of the flower, short, awl-shaped; anthers vertical, linear, simple. Pist. Germen inferior; elliptic-oblong; styles fix, deeply cloven, as long as the stamens; stigmas fimbri. Peric. Berry coated, oval, from fix to ten cells, and as many angles, tapering at each end. Seeds numerous, obovate, in two rows.

Eff. Ch. Sheath cloven. Perianth superior, in three deep segments. Petals three, Berry with fix, or more, cells.

Ofb. The anthers are occasionally imperfect in some flowers, the stigmas in others. The parts of the flower differ widely, with respect to number, in different species. Damafonium of Schreber, Willdenow, &c. has a leafy stem, though more numerously, divided sheet, with a corresponding number of angles and segments, its stamens moreover being but fix or eight, while the cells of the fruit are more numerous than in the original Stratiotes. All things considered, we prefer keeping this genus entire, as well as leaving it in the clades where Linnaeus, after repeatedly considering the subject, had determined to let it remain. This genus is very nearly allied to Hydrocharis. See that article.

1. S. aloides. Water Aloe, or Common Water Soldier. Linn. Sp. Pl. 754. Willd. n. 1. Fl. Brit. n. 1. Engl. Bot. t. 379. Mill. Illuftr. t. 50. Fl. Dan. t. 337. (Mili-taria aizoides; Ger. En. 825. Lob. Ic. v. 1. 375.)—Leaves sword-shaped, channelled, with a prominent rib, and fringed with sharp prickles.—Native of ditches, ponds, and flow streams in the north of Europe. Abundant in the feney parts of England; flowering in July, and sometimes entirely occupying the surface of the water, excluding all other plants. This herb is truly floriferous and perennial, though each root flowers but once. The parent plant, rooted in the mud after flowering, sends out buds of leaves, and the ends of long runners. These rise to the surface, form a fibrous appendage, root, bloom, and then sink to the bottom, where they implant themselves in the mud, sometimes ripen seeds, and always become the parents of another race of young offsets. The leaves are all radical, forming a star-like tuft, as in Aloes, Sedum, Saxifraga, &c. They are smooth, brittle, vorticaceous, and pulilucid, about a span long, with very sharp faw-like teeth. Flower-flats several, short, compressed, smooth, each bearing one erect white flower, an inch in diameter, from a deeply divided, or two-leaved, compressed head. Stamens twenty, connected with their base. Styles fix, 2. S. acrooides. Indian Water Soldier. Linn. Suppl. 268. Willd. n. 2. (Acorus marinus; Rumph. Ambon. v. 6. 101. t. 75. f. 2.)—Leaves sword-shaped, flat; slightly ferrated at the end. Sheath bearded.—Native of the islands of the Indian ocean, wherever the shore is flat and sandy. The root is perennial, somewhat tuberous and jointed, like that of an Acorus. Leaves radical, four feet long; crowded, linear, thick-edged, very smooth, entire, rounded at the end, and somewhat ferrated thereabouts. Stalk simple, single-flowered, smooth, three or four feet high. Sheaths of two leaves; their keel groove, with fibres towards the top. Petals fimbri, white, tinged with red. Filaments scarcely any. Anthers twelve, linear, acute, compressed. Berry ovate, compressed, hairy, as big as a hen’s egg, of from four to fix cells. Seeds fourteen or more. There appears no reason to think, with Willdenow, that the anthers above described are nectararies.

3. S. nymphaoides. Shield-bearing Water Soldier. Humboldt and Bonpland M.S. Willd. n. 3. "Leaves roundish, petalate, floating as well as the stem." Found in India, in the Calcutta district. Root perennial. Stem round, floating. Leaves entire. Stamens axillary, of two leaves, with one or two flowers, which are twice the size of S. aloides.

4. S. albispira. Broad-leaved Water Soldier. Linn. Sp. Pl. 754. Mant. 405. Sm. Exot. Bot. v. 1. 27. t. 15. (Damafonium indicum; Willd. Sp. Pl. v. 2. 276. Ait. v. 2. 331. Roxb. Coromand. v. 2. 45. t. 15. Curt. Mag. t. 1201. Ottel amelh; Rheed. Hort. Malab. v. 11. 95. t. 46.)—Leaves broad-ovate, entire. Sheath slightly divided, with several dilated ribs.—Native of ponds in the East Indies. Dr. Roxburgh sent it to the late lady Amelia Hume, in whose flow it flowered in the autumn of 1804. The root is tuberous, perennial, with many long simple fibres. Stem none. Leaves on long radical foot-flats, almost heart-shaped, bluntish, entire, many-rubbed, smooth. Flower-flats simple, angular, almost as long as the leaves, each bearing a solitary white flower, of very short duration, not unlike a Trillium in size and general aspect. The sheath, an inch or more in length, is closely attached to the stem, in the same way as the anther, with a small appendage to it. Stamens eight, with vertical, linear, orange columns. Styles eight,
eighth, with cloven, linear, yellow fīrmus. Berry cylindri-
cal, winged by the sheath, having eight cells, and numerous
elliptical seeds.

This species being so very variable as to number, in the
parts of fructification, and two of the foregoing ones dif-
fering so much from each other in that particular, prove the
characters derived from hence, in this genus, to be of no
value. S. sidero, moreover, in itself, overthrows whatever
depends on sexual distinctions. The only mark by which
Damasium could be kept separate, is the sheath being of
one leaf, very slightly divided. The number of its lobes
and angles is too uncertain to be depended upon.

STRA, in Biography, a philosopher of Lampsacus,
who succeeded Theophrastus in the Peripatetic school, and
took charge of it in the 3rd year of the 13th Olympiad,
B.C. 286, and predeceased it 18 years, with a high degree of
reputation for learning and eloquence; and from his attach-
ment to natural philosophy, he obtained the appellation of
"Physicus." Ptolemy Philadæus chose him for his pre-
ceptor, and recoumed his services with a present of 80
talents. None of his works have reached our time. His
constitution was feeble, and it is said that he lost the
powers of perception before his death, which happened
about the end of the 12th Olympiad. In his opinion
concerning matter, Strato departed essentially from the
sytem both of Plato and Aristotle, and he is said to have
approached that system of atheism, which excludes the
Deity from the formation of the world. From Cicero
(Denat. Deor. l. i. c. 13.) we learn, that he conceived
divine power to be seated in nature, which possesses
the causes of production, increase, and diminution, but is
wholly destitute of sensation and figure: and the fame
author, in his Tuscul. Quæst., informs us, that he had nothing
in common with the atomic principles of Democritus,
but ascribes every thing to certain natural motions and librations.
Brucker gives the following abstract of his opin-
ions: that there is inherent in nature a principle of motion,
or force, without intelligence, which is the only cause of
the production and diffusion of bodies: that the world
has neither been formed by the agency of a deity, distant
from matter, nor by an intelligent animating principle,
but has arisen from a force innate to matter, originally excited
by accident, and since continuing to act, according to the
peculiar qualities of natural bodies. It does not appear,
that he expressly either denied or allerted the existence of a
divine nature; but in excluding all idea of deity from the
formation of the world, it cannot be doubted, that he in-
directly excluded from his system the doctrine of the ex-
istence of a Supreme Being. Strato also taught, that the
feet of the soul is in the middle of the brain, and that it
only acts by means of the senses. Brucker by Enfield,
vol. 1.

STRA, in Ancient Geography, a town of
Asia Minor, in the mountains of Caria; in which was a
theatre. It was founded by the Macedonians, and derived
its name from Stratonice, the wife of Antiochus Soter.
It preserved its liberty for a long time under the Romans,
and the emperor Adrian partly rebuilt it. It was encoun-
tered by ramifications of mount Taurus. Jupiter Chry-
saerus had a temple near this city, where deputies of the
inhabitants of the towns of Caria annually assembled to offer
sacrifices, and to tranflect the affairs of their federative
republic.

STRA, or STRATONICEA, a town of Asia
Minor, near mount Taurus; called Stratonice ad Taurum by
Strabo, in order to distinguish it from the Stratonices of
Cara.
bathing are accommodated with lodgings. There has of late years been a considerable increase in the trade of this place: the chief exports are timber, bark, and oats; the imports, coal and lime-flour from Wales, and grocery, &c. from Bristol. The harbour, on account of its sands, is beset with reefs from 50 to 60 tons; but some of from 80 to 90 tons occasionally enter it: one of upwards of 90 tons was built here in 1813. Great quantities of sea-fish are carried from Bude for manure, not only into the neighbouring markets, but to several places in the north of Devon. Stratton derived some degree of historical importance from the great victory obtained in its immediate vicinity, in the early part of the civil war, by the forces of Charles I., commanded by Sir Ralph Hopton, over those of the parliament, under the earl of Stamford. The latter was encamped on a steep hill, with thirteen pieces of cannon, and 5,400 men; and early on the 16th of May, 1642, was attacked, with a very inferior force, by the royalists, who ascended the hill in four places at once, and after a desperate conflict, met together on the summit about 3 o'clock in the afternoon, having entirely cleared the hill of the enemy, and taken their camp, baggage, ammunition, and cannon. Sir Ralph, in consideration of his eminent services in this battle, which are specified in his patent, was created lord Hopton of Stratton. After his death, Charles II. (then in exile) in 1658 created sir John Berkeley, to whose courage and good conduct the victory has been chiefly attributed, baron Berkeley of Stratton: this title became extinct in 1773. In 1797, lord Dunfanville was created baron Basset of Stratton, with remainder to his daughter and her issue male. Lytton's Magna Britannia, vol. iii.

Stratton, a township of America, in Windham county, Vermont, about 15 miles N.E. of Bennington, containing 265 inhabitants.

Stratusch, a river of Walachia, which runs into the Siret at Adrud.

Stravadium, in Botany, a moft barbarous name, taken from the Samnivadus of the Hortus Malabaricus, and used by Jullien, Gen. 326, to designate a genus separated by him from the Linnean Eugenia, chiefly because of its racemofer inoffensiveness and angular shape. It contains Eugenia racemosa and acutangula, with Butonis alba of Rumph. Ambon. v. 3, which, though quoted for the former by Linneus, appears in Jullien's opinion to be distinct.

Stravaganza, Ital. a word exalted into a musical term by Vivaldi in the early part of the last century. Vivaldi, a Venetian, and a musician of the Lombard school, with much rapidity of bow and finger, was a voluminous composer, not only of solos, fantasias, and concertos, for his own instruments, but operas for the theatre and masses for the church. In our younger days, the fifth concerto of Vivaldi, composed of rattling passages in perpetual semiquavers, was the making of every player on the violin, who could mount into the clouds, and imitate not only the flight, but the whistling notes of birds. His last set of twelve concertos are, with due propriety, filled his Stravagancies; being full somewhat more extravagant, capricious, and eccentric than the rest. But this rapidity and difficulty are only comparative with the other strains of Corelli, Albinoni, Alleti, and Tedeschi; it was all plain failing, at the rate of ten knots an hour; there was no difficulty of softhenuto, expression, or modulation to encounter. See Vivaldi.

Straubing, in Geography, a town, with a castle, of Bavaria, situated on the Danube, and containing a collegiate church, and four convents, and having also a church without the town; 43 miles N.W. of Passau. N. lat. 48° 47'. E. long. 12° 30'.

Straublich, a town of Bavaria, in the bishopric of Bamberg; 13 miles N.E. of Bamberg.

Strausch ιΕγιδους, in Biography, a German mathematician and Lutheran divine, was born at Wittenberg in 1632, and after a course of education in his native place, he removed to Leipzig, where he continued two years, taking, on his return, the degree of master of arts. In 1652 he became assistant of the philosophical faculty, disputing on the occasion "De Periodo Juliano," and on other chronological subjects. In 1659 he was made professor of mathematics, and having obtained the degree of doctor in divinity, he was appointed, in 1664, to be professor of history. In 1669, having declined other invitations, he accepted the invitation of the senate at Danzig, to be professor of theology, and pastor of the church of the Holy Trinity, and removed thither; but as he experienced much opposition from the Catholic and Calvinistic inhabitants, he accepted, in 1675, a call to Hamburg. In his voyage thither, he was captured and carried to Colberg. As soon as he recovered his liberty, he made an attempt to go to Hamburg by land, but was arrested at Stargard, by order of Frederic-William, elector of Brandenburg, because he had preached too violently against the Calvinists. On this occasion he was thrown into prison, where he remained three years, never during that time shaving his beard; and he might have been doomed to a longer confinement, if the people of Danzig, and even the Calvinists themselves, had not interceded for him, and obtained his release in 1678. He then returned to Danzig, regained his former employments, and there died of the jaundice in 1682. At the request of the theological faculty at Wittenberg he wrote in defence of the Lutheran doctrine, for which he was a fervent advocate. His mathematical works are, "Geographia Mathematica;" "Doctrina Astrorum Mathematica;" "Tabulae per Univerian Mathethin Summopere necessarum;" "Tabulae Sinuum et Tangentium et Logarithmorum." His other productions consist chiefly of dissertations relating to chronology and scriptural subjects. Gen. Biol.

Strauersdorff, in Geography, a town of Austria; 9 miles W. of St. Polten.

Straviko, a town of European Turkey, in Bulgaria, on the Black sea; 40 miles S.E. of Ivanell.

Strausberg, a town of Brandenburg, in the Middle Mark; 33 miles W. of Cuftrin. N. lat. 52° 38'. E. long. 13° 53'.—Also, a town of Germany, in the county of Schwartzburg Rudolstadt; 6 miles W. of Sonderhausen.

Strausfurth, a town of Saxony, in Thueringia; 4 miles S. of Weißenfels.

Straussberg, a town of Brandenburg, in the Middle Mark; 13 miles S.E. of Bernau. N. lat. 52° 37'. E. long. 13° 52'.

Strausseneck, a town of the duchy of Sturia; 12 miles S. of Windisch Gratz.

Straw, in Agriculture, the common name of the stalk or stem on which grain grows, and from which it is threshed, or of any other similar material. The first is an article of cattle food, which requires some management in order to confine it to the greatest advantage, and with the most economy. In employing it for forage-cattle, or other stock, it should constantly be made use of when first threshed out; as by keeping it gets musty, and is not by any means eaten so well or completely by cattle: in this view, the threshing out large quantities at a time by the threshing machines, and

and
STRAW.

and flacking, or putting it up in other ways, is unfavourable to the perfect consumption of the fodder, and the thriving of the farm-flock. There is likewise another point necessary to be regarded in respect to this article as fodder, which is, that the inferior sorts should be first and recourse to, and afterwards those of the better kind. And in giving it, too much should not be placed before the animals at once. It has been observed by Mr. Marshall, in his "Rural Economy of Yorkshire," that straw, of every kind, is there bound upon the threshing floor. This, when straw is not used at the time of threshing, would, he thinks, in any country, be good economy; straw in trusses is much better to move, lies in less room, and retains its flavour longer than loose straw does. In a country where cattle in winter are universally kept in the house, and foddered at stated meal-times, the binding of straw becomes, he thinks, essential to good management. Each truf, provincially "fold," contains an armful, as much as the arms can conveniently "fold;" and this is the usual meal for a pair of cattle. Thus the buisness of "foddering" is facilitated, and a waste of straw avoided.

It has been remarked by Mr. Young, that if the cattle are fed with straw, it should be done with attention. The belt farmers in Norfolk are generally agreed, he says, that cattle should eat no straw, unless it be cut into chaff mixed with hay; but, on the contrary, that they should be fed with something better, and have the straw thrown upon them, to be trodden into dung: and he is much inclined to believe, that in moist, if not in all cases, this maxim will prove a just one. The common calves of straw-feeding are, of cows, young cattle, or black cattle just brought in, and not yet put to fasting. With regard to cows, the food is certainly, he thinks, insufficient, which lets them down so much in flesh, that when they calve, and are expected to yield productively, they lose a considerable time, and that perhaps the most valuable, in getting again into flesh, before they give their usual quantity of milk; but if they have been well and sufficiently wintered, they are half furred, and yield at once adequately. And that for young cattle, it is still worse management; for their growth is flunted, and they never recover it. It is his opinion, that black cattle from poor mountains had better be put to fast, than eaten than when, and, again, care must be taken that the system be not deranged by it. If well fed, and the beasts be not large, they may be cleared off between harvest and the end of November; but if they are wintered on straw, this may not be effected, and the farmer may be forced to put himself to the expense of corn or oil-cake, to feed beasts not of a fine to pay well enough for those articles. The evil is less if he has plenty of turnips or cabbages; but for these he may have other applications. In so far as regards the quality of the farm-yard dung, all this reasoning becomes still more forcible; for from straw-fed cattle, the farmer will, at the end of winter, find perhaps a large heap, of so poor a quality, that it will go but a little way in manuring his fields; whereas, one load of dung made by fat or well-fed cattle, will be equal to two or three of such as have been fed poorly. But cut chaff, one half hay and the other half straw, affords very well, especially with some sort of succulent food. And it has been stated by the author of the "Synopsis of Husbandry," that bean-straw, if well harved, forms a very hearty and nutritious diet for cattle in the winter-time, and both oxen and horeses, when not worked, will thrive upon it; sheep also are very fond of browsing upon the pods, and the chaff is a very nutritious manger-meal. Mr. Young also suggets the great importance of putting beans in sufficiently early, and the reaping food enough, as the straw, well harved, is worth from 2£ to 3l. per acre; and that Mr. Arbuthnot's teams, which were always hard-worked, never had a truf of hay while the bean-straw lasted. Pea-straw, or haalm, when well got in, is likewise, in a great measure, equally nutritious, if cut into chaff, and given in that way as a fodder.

However, it has been stated by Mr. Marshall, that he met with an idea that cattle may be fattied with straw; or, in other words, may be served with it in too great plenty. It has been observed, that after a dry summer, when straw is scarce, and the cattle have it dealt out to them regularly, in not too large quantities, they do better than when,after a plentiful year, it is thrown before them in profusion from the threshing floor, not through the superior quality of the straw in a scarce year; as these effects have been observed to be produced from the same straw. This subject is by no means unintereasting to those who winter large quantities of cattle: he has observed in Yorkshire, where cattle are tied up, and of course are regularly fed, that they in general do better at straw, than cattle in the south of England, where they go loose among a much greater plenty; but whether the profit from this warmth, from their refting better, from the breed of cattle, or from their being regularly fed and eating with an appetite, he will not pretend to decide.

But where this sort of fodder can be wholly consumed by the store-flock, it is probably a better method to make use of it in that way, than by letting the yards with it, as the manure is without doubt much superior, and other articles, such as fern, &c., may, in many cases, be provided as little as with straw. And the quantity of manure, where an abundance of straw is at command, that may be raised by littering animals that are feeding and fattening in the fields or yards, especially where much green food is used, is very great, and often of vast importance to the farmer, as has been stated in considering the means of fattening animals. Therefore, the use of straw, both as the food of cattle and for litter in the yards, must be of very great importance to the farmer in a great many instances. See STALL-Feeding.

The use of straw, of wheat-straw, which is often permitted, is not unfrequently a matter of great advantage in different situations. The use of the cut straw, or haalm, of pulp crops, has lately, too, been found very great in the feeding out or fattening different sorts of cattle and other animals.

It has been lately stated, by Sir Humphrey Davy, that dry straw of wheat, oats, barley, beans, and peas, and spoiled hay, or any other similar kind of dry vegetable matter, is, in all cases, useful manure. That, in general, such substances are made to ferment before they are employed, though it may be doubted whether the practice should be indiscriminately adopted.

In examining this material chemically, from four hundred grains of that of the dry barley kind, he obtained eight grains of matter soluble in water, which had a brown colour, and tasted like mucilage. And from the same quantity of wheat-straw he gained five grains of a similar substance.

It is thought that there can be no doubt that the straw of different crops immediately plunged into the ground, affords nourishment to plants; but that there is an objection to this method of using straw, from the difficulty of induding and completely burying such as is long, and from its rendering the humusy soil, or in a littery state.

Where straw is made to ferment, it becomes a more manageable
manageable manure; but there is likewise, on the whole, a great loss of nutritive matter. More manure is perhaps, it is thought, supplied for a single crop; but the land is left improved than it would be, supposing the whole of the vegetable matter could be finely divided and mixed with the soil.

It is usual, it is said, to carry straw that can be employed for no other purpose to the dunghill, to ferment and decompose; but that it is worth experiment to ascertain, whether it may not be more economically applied when chopped small by a proper machine for the purpose, and kept dry until it is ploughed in for the use of a crop. In this case, though it would decompose much more slowly, and produce less effect at first, yet it is thought, would be much more lasting, and perhaps ultimately more beneficial.

**Straw, Pea, Hacking of,** the cutting up and reaping of the pea crop, in the haum, in the field, when down by the drill or hand, in the firmed manner. It is performed by means of two hooks of the reaping kind, by one of which the straw or haum is held up from the ground, while it is cut off by the other in a sort of hacking mode, and then laid into small heaps, or, as they are often termed, wads.

**Straw and Hay Ropes for protecting and preserving Fruit-tree Blossoms and other Crops,** in Gardening, the means of guarding or securing them, by such materials, from the effects of severe frosts, and other causes of mischief, injury, and destruction, to which they are liable and exposed. This is a method which is stated to have been practiced with great success in the more northern parts of the island, in different years entered in the Memoirs of the Caledonian Horticultural Society.

It is to be effected, as soon as the buds of the trees begin to have a turgid and swelled-out appearance, by placing and fixing up poles before the walls, about a foot from them, at four to six feet distance from each other; the lower ends being sunk a little into the ground, and the upper ones rising so as just to reach below the copings of them; securing the tops of those at each end of the particular spaces or divisions, by means of a strong nail or half-fall, to either the walls or copings, in order that the ropes may be kept tight and firm. Then, having the necessary quantity of straw or hay ropes ready prepared, the work is begun by fixing one of them near the top to one of the outside poles, proceeding horizontally to the other, padding the rope on from pole to pole, and taking a turn of it round each, until it is reached, where it is made secure. When at eighteen, or, if necessary, twenty, another line of rope is begun again, and carried across in exactly the same manner; and so on until within from eighteen inches to three feet, as may be requisite, of the ground is reached, when the work is completed. The method is said to be both cheap, and, so far as experience has gone, extremely efficacious. Besides, as the covering does not much intercept the rays of light or of the sun, it may be applied early, and be let remain, although the fruit be let, until the weather becomes settled, towards the middle or end of the month of May. In the first trial of this method, a peach tree had been covered, on a wall where there were many others. A heavy fall of snow took place afterwards in the beginning of the above month, and on the morning after this fall, about five o'clock, the thermometer was at two degrees and a half below the freezing point: the consequence was the loss of the whole uncovered crop, except a few fruit which were protected by the foliage of the trees; while the tree that was covered and protected produced a fine crop of fruit.

As the writer is of opinion that the parts of fructification are not unfrequently hurt before the flower is expanded, he advises that the ropes be put on at a sufficiently early period.

Where poles are scarce, the ropes, it is said, may be fixed in a perpendicular manner, the upper ends being fastened by a proper nail to the wall, and the lower or bottom ones by a peg firmly driven into the ground. But in this way, the ropes are very apt to beat off the flower-buds in times of high winds.

The branches of different evergreens, as well as old fish-nets, as those of the herring and other kinds, have been employed for the purpose of protecting fruit-tree blossoms, but nothing that has yet been tried has been found to answer the end so well as these kinds of ropes. Besides, they are cheap, and to be obtained in almost any situation. However, woollen nets, which are much recommended for this use by some, the writer has never had the opportunity of trying. Such nets are probably too expensive for common practice in these cases.

It has also been found, that these sorts of ropes are very useful in protecting and preserving other early garden crops from the effects of the cutting frosty winds and severe frosts which often prevail in the early spring season; such, for instance, as early peas, beans, potatoes, kidney-beans, and some others; which is done simply by fixing them along the front of the different rows, by means of pegs or pins driven firmly into the ground.

It is probable that this cheap and ready method of protecting and preserving fruit-blossoms, and crops of other kinds, may be practiced and had recourse to in preference to those of a more expensive nature; as nets of several sorts, canvas, and some others, that are in pretty common use, in many situations and circumstances, especially in the more northern parts of the kingdom.

**Straw, Collar, in Rural Economy,** a fort of collar stuffed or formed wholly of this material, instead of that of the hair kind, which is the most suitable and proper for the purpose. It is a fort still much employed in some backward districts. In Cornwall, the draught-harness for horses and other animals in the ploughs, as well as the harrows, often consists; it is said, of a straw collar, called there a brow, with wooden cellars-trees, to which are fastened rope-traces.

**Straw, Cutter, in Agriculture,** a name sometimes applied either to the perfor or implement by which straw is cut into chaff. See Chaff-Cutter.

In order to save labour as much as possible, the power of water and steam has lately been much applied in the cutting of straw for chaff.

**Straw, Drains,** a term applied to those sorts of surface-drains which are filled with straw in some way or other. See Surface-Drain.

**Straw, House,** a name applied to the place for piling up straw. These contrivances are very convenient in most situations.

**Straw, Ricks,** a term used for such as are formed of straw of different kinds. See Stack.

**Straw, Twisting Machine,** the name of an engine or contrivance for twisting straw into ropes, for the purpose of filling the drains in some cases of surface under-draining. See Surface-Draining.

**Straw-Yard,** that fort of yard about farm-houses which is defined for the reception of the straw after the grain has been threshed out of it. It also sometimes signifies the yard which is prepared and littered with straw for the use of neat cattle and other animals, as well as the yards into which saddle and other horses are taken during the winter season, to be fed on straw and other similar matters, in a cheap manner,
strewberry, in Botany and Gardening. See Fragaaria. See also Summer Fruit.

Sir Joseph Banks, in a paper inserted in the first volume of the Transactions of the Horticultural Society of London, in speaking of the revival of the old neglected mode of managing strawberries, remarks, that the custom of laying straw under plants of this kind, when their fruit begins to swell, is probably very old in this country: the name of the fruit, it is thought, bears testimony in favour of this supposition, for the plant has no relation to straw in any other way, and no other European language applies the idea of straw in any shape or manner to the name of the berry, or to the plant that bears it. Consequently, that the name strawberry perhaps originated in the use of this practice in its management.

In respect to this custom or practice, it is noticed by the writer, that when he came to Spring-Grove, his country residence, in the year 1779, he found this practice in the garden there. John Smith, the gardener, who was well known among his brethren as a man of more than ordinary abilities in the profession, had used it at that place many years; he had learned it, it is said, soon after he came to London from Scotland; probably at the neat-houses, where he first wrought among the market-gardeners; it is therefore thought to be clearly an old practice, though now almost obsolete.

However, its use in preferring crops of this sort of fruit is flattered and recommended as very extensive: it shades the roots from the sun; prevents the wafte of moisture by evaporation; and consequently in dry times, when water is scarce, and watering necessary, makes a lefs quantity of it suffice than would be used if the sun could act immediately on the surface of the mould; besides, it keeps it, is said, the leafruit from refting on the earth, and gives the whole an air of neatness, as well as an eftect of real cleanliness, which should never be wanting in this sort of culture, or in a gentleman's garden.

It is further stated, that the strawberry-beds in the above garden, which have been measured, for the purpose of ascertaining the expense incurred by this method of management, were about twenty-five feet long, and five feet wide, each containing three rows of plants, and, of course, requiring four rows of straw to be laid under them. The whole consists of fix hundred feet of beds, or one thousand eight hundred feet of strawberry plants, of different sorts, in rows. The quantity of straw for strawing these beds, which was consumed in the year 1806, was, it is said, the long straw of twenty-fix trifles, for the short straw, being as good for the purposes of litter as the long, but less applicable to this use, is taken out; if then on the original twenty-fix trifles, fix be allowed for the short straw taken out and applied to other uses, twenty trifles will, it is said, remain, which will last this year ten-pence a truf, or fixteen shillings and eight-pence, which is one penny for every nine feet of strawberries in rows. And from this original expenditure, the value of the manure made by the straw when taken from the beds must be deducted, as the whole of it goes undiminished to the dung-hill as soon as the crop is over. The cost of this practice cannot, therefore, if is supposed, be considered as heavy: in the above year, not a single flower fell; it is said, at the above place, from the time the straw was laid down, until the crop of scarlets was nearly finished, at the end of June. The expense of strawing was therefore, it is noticed, many times repaid by the saving made in the labour of watering, and the profit of this sav-
seem to be deserving of more attention than has yet been bestowed upon it.

**Strawberry.** _Bram and wild eating_ are common in pastures, heaths, and hedge-banks. The latter is the parent of the cultivated kinds, and which has a most delicious fruit.

See **Fragaria**.

**Strawberry-Blite.** See Blitum.

**Strawberry-Queiral.** See Potentilla.

**Strawberry-Spinach.** See Blitum.

**Strawberry-Tre.** See Arbutus.

**Strawberry-Trefoil.** See Trefoil.

**Strawberry Bay,** in Geography, a bay which is neither large nor deep, on the coast of a small island in the gulf of Georgia. N. lat. 48° 36'. E. long. 37° 34'.

**Strawberry Gap,** a mountainous pass in Pennsylvania, 42 miles W. of Philadelphia, on the road to Lancaster.

**Strawberry River,** a river of North America, so called from the great quantities of strawberries that grow on its banks; which runs into lake Superior to the W. of God-dard's river, N. lat. 46° 40'. W. long. 91° 44'.

**STRAW,** in *Rural Economy,* a term signifying the dock of a horse without the hair; also the tail of slaughtered cattle or sheep, where the skin is removed.

**STRAY,** in Geography. See Yenlade.

**STRAY.** See Estray.

**STREAK-FALLOWING,** in Husbandry, a particular sort of tillage. The way of doing it is to plough one furrow, and leave one, so that but half the land is ploughed, each furrow that is filling on that which is not; when this is flurred, it is then clean-ploughed, and laid off smooth, that it will come at sowing time to be as plain as before. This is done when lean or poor lands are not fayrd enough to bear clean tillage, nor fayrd enough to lie to get foward. The intent of this tillage is to keep the fun from scorching them too much; but in many places they think this wears the land too fayrd, and therefore are not fond of having recourse to it.

**STREAKY CHEESE,** in Rural Economy, that sort which is of a streaky nature or kind, in consequence of being made from a mixture of old and new curd, or of two sorts, which have different proportions of colouring matter in them, that gives them a streaky appearance. The practice of mixing curds of different kinds and qualities should be carefully avoided in cheese-making. See Dairying.

**STREAM Anchor.** See Anchor.

**STREAM Cable.** See Cable.

**STREAM-Tin,** in Mineralogy. Particles or masses of tin-ore found beneath the surface of alluvial ground in low situations, or in valleys, are called *stream-tin* in Cornwall and Devonshire, from the processes used to separate the earthy matter from it, which consists in palling a stream of water over it. The particles of stream-tin are generally rounded by attrition. The ore is of the best quality, and is sometimes intermixed with particles of native gold. See the following articles, and Tin.

**STREAM-Works.** The alluvial repositories of tin-ore are called stream-works. (See the preceding article.) They consist of beds or strata of particles, and rounded pieces of tin-ore, covered by alluvial deposits of sand or gravel. The formation of these repositories in Cornwall is owing to the soft decomposing state of the rocks, which are interfaced by metallic veins. Tin-fence or tin-ore polishes great hardness and specific gravity, and when carried down by rivers or floods, is separated from its matrix by the action and re-action of the water, and spread into layers, which are afterwards covered by beds of sand, clay, or gravel, over which another layer of stream-tin is sometimes found covered with an upper deposit of alluvial matter. That stream-tin has been carried down to the situations in which it now occurs, is proved from another circumstance,—fragments and masses of rock are found with it, which, in many instances, serve to identify the rock from whence it came, being different from the rocks in the vicinity, and often polishing some characteristic appearance by which it can be immediately known to the miners of the country. Almost all the rocks of Cornwall are in a state of rapid disintegration, and have evidently been much more than at present at some former periods. Many of the stream-works or repositories are of very ancient date, as they occur considerably below the present level of the rivers. Human skulls, and the horns of the elk, or stag, have been found in the beds of land which cover them. In the stream-works near St. Auffle, pieces of native gold, from the size of a bean to that of an hazel-nut, were occasionally found; and a piece of a vein of quartz from the same place, about one-third of an inch thick, containing imbedded globules of native gold, the size of large shot, is in the possession of Mr. Hennah, of Plymout h; the latter is important, as proving that gold once existed in regular veins. In St. Blasey Moor there is a depth of twenty feet of alluvial soil. The first stratum next the surface is composed of gravel resting upon mud; the succeeding stratum is gravel, containing a little tin-ore; this lies upon a bed of dark combitubulous peat-earth. Immediately under this lies a bed of stream-tin, about five feet thick. Great part of this stream-tin had been wrought out at a very remote period, and before iron utensils were in use; for several wooden pick-axes, made of oak, holm, and box, were discovered in it a few years since. Stream-works sometimes extend under the sea on the coast of Cornwall. One of the moat remarkable of these works is in a branch of Fal-mouth harbour. That variety of tin-ore called wood-tin is found in stream-works, but is not at present met with in regular tin-veins.

In some parts of the mining districts of Derbyshire, lead-ore is met with in alluvial depositions. Mr. Farey, in his Derbyshire Report, p. 173, mentions a bed of lead-ore, 2 thick, being taken out of a gravel at the top of a hill in the village of Wyanton, which proves that masses of lead-ore have in former times been carried far from their native situations; and the reason why they are not more frequently found, arises from their being foter and more perishable than tin-ore. Many of the alluvial repositories of gold have a similar origin to the stream-works of Cornwall. The gold, being heavy and imperishable, has remained, while the materials in which it was imbedded have been washed away. See Vein.

**STREAMING,** or **Stream-Works,** denotes the management of the stream-tin. The first part of this business is, after securing the ground which contains it, to sink a hatch, or shaft, three, five, or seven fathoms deep, to the rocky shelf or clay on which the tin is stratified. If, upon trying a shovel of it, it be worth working, the operator digs an open trench in the lowest part of the valley, which he calls a level; and this serves to drain off all water from the workings. Those places that are rich in ore are called lead-ing-streams, or live-streams. The stream-tin is felled off that he calls the over-burden, i.e. the loose earth, rubble, or stone which covers the stream; and the stream-tin is dug up and washed at the same time, by casting every shovel of it into water, and before it is washed, it is sieved through a sieve, which is inclined plane of boards of the water to run off, about six feet wide, four feet high, and nine feet long; in which, with shovels, they turn it over and over again, under a cascade of water which washes through it, and separates the waste from the tin, till it becomes one half
tin. The beft of the tin is collected by its inferior gravity, in the head of the tye, under the cascade; and the refuse and foil are cast into the beds of adjacent rivers, or buried under the gravel and stones that form the interior strata. This kind of tin is dressed by washing it again in a smaller tye, called a gounce, with a less current of water, and greater care. The richer part is put into large vats, and the wafe is dressed again, till what remains becomes refuse; the tin is then sifted through wood or wire sieves, which separate the greater and smaller particles: the small left in is put into another firmly woven horse-hair sieve, called a diluter, by which it is made saleable.

Some of the nodules of tin are smelted as they come out of the tye; but those which are mixed with water, as well as the refuse of the poor tin, which were in the tails of the tye and gounce, are triturated and pulverized in the flamping-mill, so that all waste may be cleared from the tin by several abolutions, as in the dressing of mine-tin. See Drifting of Ores.

Besides these stream-works, there is another fort, occasioned by the refuse from the flamping-mills, &c. which are carried by the rivers into the lower grounds, and after lying some years and collecting there, yield some money to the laborious drawers, called lappiors, probably from the Cornish word lappor, or dancier, from the method of moving up and down with naked feet in the puddles, to separate the tin from the refuse. Stream-tin is then carried to the blast-furnace, called the blowing-house, in which a fire is made with charcoal, excited by two large bellows, which are worked by a water-wheel. The tin and charcoal are laid in a furnace, made by moor-flanes and clay, well cemented and cramped together with iron, called the cage, flatum super flatum, in such quantities, that from 8 to 12 cwt. of tin, by the consumption of from 18 to 24 sixty-gallon packs of charcoal, may be smelted in a tide, or twelve hours' time. The tin is forced out by the blast of the bellows, through a hole at the bottom of the earth, into a moor-flame trough, called the float; whence it is laded into lefs troughs or moulds, each of which contains about 3 cwt. of metal, called flabs, blocks, or pieces of tin, in which fire and form it is sold in the market in Europe. This on account of its superior quality, is known by the name of grain-tin, which formerly fetched a price of 7s., and of late is advanced to 10s. or 12s. more per cwt. than mine-tin is sold for, because it is smelted from a pure mineral by a charcoal fire; whereas mine-tin is usually corrupted with some portion of mordic, or other minerals, and is always smelted with a bituminous fire, which communicates a harth sulphurious quality to the metal. Fryce's Mineral. p. 136. &c.

STREAMERS, in a Ship, the same with pendants; which see.

STREAMS, Made, in Agriculture, such as are formed for the use of land, live-stock, or other rural purposes, by means of art. Much improvement of this sort remains to be accomplished, it is thought, in all mountain-fort situations, on the lower flages and parts of hills, and, in fact, wherever water can be fully commanded, which may often be readily done, by making canals and pailages for streams, and diverting the natural ones into them, leading them to unwatered grounds, for the various intentions and purposes of supplying water to villages, farmsteads, and lands in the state of grafs, as well as in some cafes to lands under the plough. Upon a large entire domain, situated in this manner, a proprietor may, it is said, operate at will, and accommodate the whole of his different farms in the manner that may be the most conducive to the general interest of the whole property.

In the case where a river or brook of water is capable of being spread over an extent of country, in which properties are much divided and intermixed, the aid of parliament and commissioners, it is thought, may be necessary, in order to direct and appoint the branching out of the common stream in such a manner, as may be most proper and equitable, as well as to see that the whole be completely performed and fulfilled, and for settling disputes, and regulating what time and experience may render further necessary. In circumstances where the proprietors are few and unanimous, commissioners and trustees alone may only be necessary for the purpose, and trouble and expense be thereby saved.

It is remarked by the writer of "Rural Economies of different Distriets," that not uplands only are susceptible of this form of improvement, but even low-lying vale lands, marshes, and rich feeding grounds, are not unfrequently defective of good water for pasturing-of stock; especially in the summer season, when it is most wanted.

The methods of conducting improvements in this intention are, in some measure, different according to circumstances, and the nature and situation of the grounds; but it is seldom necessary that each homestead, and each pasture or other ground, should be supplied with a constant stream. Where the quantity of water is small, in proportion to the demand for it, it may be distributed by turns among the farms and the fields, as their several occasions may require. The drinking places are likewise to be rendered proper and suitable to the supply, or the manner in which it is distributed. Where there are continual streams, the animals may drink at dilutions of their channels, or at troughs or other contrivances placed across or put along the sides of them. But where the supply is only occasional, large receptacles or receiving places, as ponds and reservoirs, become necessary, which are to be replenished from time to time, as may be requisite.

STREAMS, Mill, in Rural Economy, a term commonly applied to the leads or runs of water which conduce the moving powers of this sort of machinery, and which are mostly formed by means of art. In most of the mountain diarrietas, whether in Scotland, in Wales, or in the west of England, where the mills are, for the most part, of the over-foot kind, streams of this sort, commonly of the artificial kind, are almost everywhere to be met with, some of which are of very considerable length, and the antiquity of which cannot now be ascertained. In that diarrietas, too, where under-foot mills mostly prevail, these sorts of streams are not unfrequently to be found, as conducing the water which is to put them in motion.

Wherever cuts for streams or leads of this nature are to be formed, it should constantly be done in a secure and safe manner, so that no water may in any way be wasted or lost.

STREETHAM, in Geography, is a parish in the east half hundred of Brixton, and county of Surrey, England, which derives its name from its situation near the great Roman road from Arundel to London; the word, in Saxton, signifying a dwelling on the highway. The manor of Tooting-Bec, in this parish, was in the seventeenth century in the possession of the family of Howland; but since, it has passed by marriage to that of Rufiel, and is now the property of the duke of Bedford, who bears the title of baron Howland of Streatham. The ancient manor-house was a few years since pulled down, and the green-house and part of the offices converted into a residence. On the side of the common, between Streatham and Tooting, is Streatham-park,
pork, the property of Mrs. Fiozzi, relict of the late Henry Thrale, esq. The grounds comprehend about 100 acres, and are surrounded by a gravel-walk and shrubbery, nearly two miles in circumference. In the church are two monuments, with inscriptions by Dr. Johnson, to the memory of Mr. Thrale and Mrs. Salusbury, mother of Mrs. Fiozzi. Mr. Lysons, in his Environs of London, vol. i, notices a man of singular character, who was buried in this place in 1772, named Ruffel, and who had passed for a female; from this disguise, his age could not be precisely ascertained, but according to his own account he was 108.

On Lime Common, in Streatham parish, in 1660, a spring was discovered of a mild cathartic quality; the water from which was sent in large quantities to some of the hospitals in London. This parish was, in 1811, computed to contain 440 houses, and 3759 inhabitants.—Beauties of England and Wales, vol. xiv, Sury, by F. Shoberl.

STREBERNICH, a town of European Turkey, in the fanaticat of Bofinia, called "Argentina," from the silver mines found in its vicinity; 70 miles W. of Belgrade.


Female, on a separate plant, Cal. as in the male, permanent. Cor. none. Pist. German superior, roundish; style long, deeply divided into two branches; stigma simple. Peric. Berry roundish, two-lobed, of two cells. Seeds ovate, foliarly.


STREENDON, a town of Sileisia, in the principality of Meissen; 14 miles N. W. of Meissen.

STREHAJA, in Geography, a town of Walschia; 18 miles E. of Czernitz.

STREHLA, a town of Saxony, in the margravate of Meissen, on the Elbe; 14 miles N.W. of Meissen.

STREHLEN, a town of Sileisia, in the principality of Bries; 16 miles W.S.W. of Bries.

STREIDORFF, a town of Austria; 5 miles S.S.W. of Ehrnfurtum.

STREIGHT. See STRAIGHT.

STREIN, or STRIENUS, in Biography, an Austrian baron, with the title Von Schwartzenaus, was born about the 1508. The first object of his attention was jurisprudence, but afterwards, under the care of Francis Hotman, he prosecuted the study of Roman antiquities with such fidelity and success, that in the twentieth year of his age he composed a work "De Gentibus et Familias Romanis," which was published at Paris in 1593, fol. by Henry Stephens; and "Stemmata Gentium et Romanarum Familiarum," inserted in the 7th volume of "Graevi Thesaurus Rom. Ant." He also wrote "Commentarii de Rob. Belarmini Scriptis atque Libris," and published, without his name, "A Defence of the Freedom of the States of Holland." He died at Vienna, according to De Thou, in 1601, but, as Baillet says, in 1600. He was a decided and steady friend to the Protestant communion. —Gen. Biogr.

STREITBERG, in Geography, a town of Austria; 12 miles S.S.W. of Ebenfurth.—Alto, a town of Germany, in the principality of Culmbach, in the Burghausen; 30 miles S.W. of Breslau. N. lat. 49° 45'. E. long. 11° 10'.

STREITDorf, a town of Austria; 8 miles N. of Korn Neuburg.

STREITFORT, a town of Transtilvia; 13 miles N.N.E. of Foggara.

STRELEN, a town of Saxony, in the margravate of Meissen; 15 miles N. of Meissen.

STREITZ, Great Streitz, or Weisse Streitz, a town of Sileisia, and capital of a circle, in the principality of Oppeln; 14 miles S.E. of Oppeln. N. lat. 50° 27'. E. long. 17° 15'.

STREITZ, Old Streitz, a town of the duchy of Mecklenburg, situated in a marshy district; founded by Otho and Ulrich, counts of Furttenberg, in the year 1329, and entirely destroyed by fire in 1757 and 1676. Duke Adolphus Frederick re-sided here, but when his palace was burnt down, in 1712, he built another in the vicinity, at a place called "Glinke," and in 1733 founded a town adjoining to it, under the name of "New Streitz," supposing that in time it would be enlarged, that Old and New Streitz would become one place. Streitz gives name to one branch of the house of Mecklenburg, called Mecklenburg-Streitz; 50 miles W. of Stettin. N. lat. 53° 23'. E. long. 15° 18'.

STREITZ, Little, a town of Sileisia, in the principality of Oppeln; 14 miles S. of Oppeln.

STREITZ, a town of Scotland, in the county of Perth, built in 1763, for soldiers discharged after the German war; 10 miles N. of Perth.

STREITZ, in Botany, was so named by Sir Joseph Banks and the late Mr. Aiton, as a just tribute of respect to the botanical zeal and knowledge of the present peer of Great Britain, a prince of the house of Mecklenburg-Streitz. Few percognos of so elevated a rank have ever loved the study of nature more, or cultivated it so deeply. See the conclusion of the article Lightfoot.—Ait. Hort. Kew. ed. 1. v. 1. 285. ed. 3. v. 2. 154. Schreb. Gen. 796. Wild. Sp. Pl. v. 1. 1189. Mart. Mill. Dict. v. 4. Thum. U u 2. Prodr.

Gen. Ch. Cal. Common Sheath, inferior, of one leaf, channelled, pointed, widely spreading, many-flowered; partial ones lanceolate, shorter than the flowers. Perianth none. Cor. superior, irregular, of three lanceolate, acute petals; the lowermost boat-shaped; two upper ones bluntly keeled. Neckary of three leaves; the two longest equal, rather shorter than the petals, broad at the base, then tapering, with a folded wavy border, embracing the flowers and stamens, half arrow-shaped towards the top, with a thick dorsal appendage; the third leaf much shorter, ovate, compressed, keeled. Stam. Filaments five, inserted into the receptacle, thread-shaped, three of them embraced by one leaf of the nekary, two by the others; anthers terminal, linear, erect, parallel, about as long as their filaments, concealed in the nekary. Pfd. Germen below the corolla, oblong, bluntly triangular; stamens thread-shaped, the length of the stamens; stigma three, apical, ranging above the nekary, erect, gleued together in an early state. Peric. Capsule woody, oblong, slightly triangular, obtuse, of three cells and three valves, the partitions from the centre of each valve. Seeds numerous, nearly globose, hairy, ranged in two rows along each partition.

1. S. angustifolia. Great White Strelitzia. Thunb. Prodr. 45. Wildl. n. 2. Ait. n. 1. (Heliconia alba; Linn. Suppl. 157.)—Flower-tall half the length of the footstalks, which are scarcely twice the length of the oblong erect leaves. Native of the Cape of Good Hope, from whence it was brought to Kew by Mr. Masson in 1791. It flowers in the flower, from February to May. The root is perennial, with long and thick fibres. Leaves radical, about six feet long, resembling those of a Musa. Flowers white, bearing but a small proportion to the magnificent foliage.

Though this is what the younger Linnaeus meant by Heliconia alba, his specific character is erroneous, and the synonymy of Rumphius belongs to a species of Heliconia, not well ascertained.


3. S. angustifolia; Ait. n. 5.—Flower-tall, as well as the footstalks, seven times as long as the lanceolate leaves.

4. S. parviflora; Ait. n. 6.—Flower-tall, as well as the footstalks, twenty times as long as the linear-lanceolate leaves.

Native of the Cape of Good Hope, flowering in our flowers in the spring. Sir Joseph Banks, who has for nearly fifty years been indefatigable in enriching the gardens of this country, is recorded as having introduced this superb flower in 1773. Its habit resembles a Musa or Canna, except in the want of a stem. The leaves are smooth, rigid, and coriaceous, erect, on long, straight, stout, nearly cylindrical, smooth, radical footstalks, sheathing at the base. The form of the leaf itself is usually ovate, acute, entire; wavy or crisped at the base, especially on one side; furnished with a firming mid-rib, which tends off several simple, oblique, parallel, transverse veins. Scales one or two, at the top of the cylindrical, simple flower-tall, nearly horizontal, thick and rigid, purplish and thin at the edges, acute, four or five inches long, each containing many flowers, which expand in succession. The orange-coloured petals, three or four inches long, are strikingly contrasted with the blue-purple stamens, both together composing one of the most brilliantly coloured flowers in nature. We presume to think the S. ovata of Hort. Kew. does not deserve to be marked as even a variety, nor do the figures quoted answer to the character. The angustifolia, recorded as having been cultivated by the marquis of Rockingham in 1778, we can aver to be a mere variety of the Regina. If we mistake not, it was given to the marquis by Mr. Bamber Galcoyne. Of this we are certain, that offsets of the original root, in the flowers of the late marchioness, where for many successive years we have observed them, gradually diminishing in the size and breadth of their leaves, became first S. angustifolia, and then parviflora, of Hort. Kew. Similar varieties may indeed have been fresh imported from the Cape, but this does not prove their specific difference. In some specimens the leaf dwindles to a mere point.

3. S. farinosa. Mealy-tall Strelitzia. Ait. n. 4.—"Stalk rather longer than the footstalks, which are half as long again as the oblong leaves, unequal at the base."—Native of the Cape. Flowering in the flowers at Kew in February and March. It was introduced by Sir Joseph Banks in 1795. With this we are unacquainted, and therefore cannot prejudice to judge how far it is specifically distinct from the foregoing.

Strelitzia, in Gardening, affords a plant of the herbaceous, exotic, perennial kind, of which the species cultivated is the Canna-leaved Strelitzia (S. reginae). Method of Culture.—These plants are raised from seeds brought from their native situation, and sown in pots of good fine mould, being plunged in a hot-bed to get them up: the plants, when of some growth, should be removed into separate pots, and be replanted in the bed, in the fall; afterwards, when the plants are large, they should have plenty of mould, that the roots may be extended into the rotten tan, and in that way render them more strong for blowing their flowers: it may likewise sometimes be raised from the roots, when they are suffered to strike in the above manner: it is said to succeed better in the dry flower and conservatory departments.

This is highly ornamental among flower-plants.

STREME, in Geography, a river in Brandenburg, which runs into the Oder near the S. of Rathenow.

STREW, in Antiquity, new-year's gift; presents made out of respect on new-year's day, as an happy augury for the ensuing year.

The ancient lawyers derive the word hence, that these presents were only given vires flumen: Symmachus adds, that the use of them was first introduced by king Tattius, Romulus's colleague, who received branches of vervain gathered in the sacred grove of the goddess Streuna, as a happy preface of the beginning year. Angrily, a pound of gold was given to the emperors every new-year's day, by way of frons. Du-Cange observes, that frons, or frima, denoted a kind of tribute which the people of Dalmatia or Croatia paid to the Venetians, or to the kings of Hungary, whom they obeyed voluntarily.

STRENBERG, in Geography, a town of Austria; 10 miles E.S.E. of Ens.

STRENG, a river of Brandenburg, which runs into the Havel at Brandenburg.

STRENGNAS, or STROGOMAS, a town of Sweden, in the province of Sudermanland, situated on the Meier lake: it is the seat of a bishop, and has a celebrated gymnium,
STRENGTH, 

It has been said that the strengths of different animals of the same species, or of the same animal at different times, are in a triplicate proportion of the quantities of the maws of their flesh: the whole strength of an animal being the force of all the muscles taken together; therefore, whatever increases the strength, increases the force of all the muscles, and of those serving digestion, as well as others. See MUSCLE.

Yet, though the truth of this observation be allowed, the quantity of blood may be increased in such circumstances as to abate the strength. The equilibrium between the blood and vellere being destroyed, wonderfully lessens the strength. The sudden suppression of perspiration, though it increases the quantity of the blood, as it must considerably do by, it lessens the strength; because the retained matter, being what ought to be evacuated, alters the texture of the blood, as to make it unfit for muscular motion.

Suppose the increase of quantity to be connected with an extraordinary vividness, the quantity of small separable parts decreasing as the vividness increases, the quantity of animal spirits separated in the brain will be less; and the tension of the fibres being in proportion to the animal spirits forced into them, they will not be able to counterpoise the great weight of the blood, and so the strength will be diminished.

Bellini proves, that if the blood be so vitiated as to increase or diminish strength, it amounts to the same if the blood were in a natural state, but its quantity increased or diminished in the same proportion; so that the blood, when vitiated, may so impair the strength of the muscles, as even to spoil digestion, and yet, in some cases, it may be so vitiated as to help digestion, and increase strength.

M. de la Hire, in a calculation of the strength of a man in drawing and bearing, shews, that the strength of an ordinary man walking in an horizontal direction, and with his body inclining forwards, is only equal to twenty-seven pounds; which is much less than one would have imagined.

He adds, that this force would be much greater, if the man were to walk backwards; and that it is for this reason, that watermen fetch their casks from before backwards: and though, he observes, the gondoliers of Venice fetch them the contrary way, yet this is, because they choose to lose the advantage of strength, to have that of seeing the place they are going to, in the numerous turns and canals they there meet with.

It is known by experience, that a horse draws, horizontally, as much as seven men; consequently, his strength will be 189 pounds. A horse, as to pushing forwards, has a great advantage over a man, both in the strength of its muscles, and the disposition of the whole body; but the man has the advantage over the horse in ascending. M. de la Hire shews, that three men, laden with 100 pounds a-piece, will ascend a pretty steep hill with more ease and expedition than a horse laden with 300 pounds.

Hakewell, in his Apology, p. 238, furnishes us with abundance of instances of extraordinary strength.

STRENGTH, in Grammar and Rhetoric, denotes such a disposition or arrangement of the several words or members, as shall bring out the sense to the best advantage, render the impression which the period is designed to make most full and complete, and give every word and every member their due weight and force. A sentence, as Dr. Blair observes, may be sufficiently clear, and possess the requisite compactness or unity; and yet, by some unfavourable circumstance in its structure, it may fail in that strength or liveliness of impression, which would have been produced by a more happy arrangement. The first rule, which this writer gives, for promoting the strength of a sentence, is to divide it of all redundant words and members. The second rule is to attend particularly to the use of copulatives, relatives, and all the particles employed for the sake of connection. The third rule is to dispose of the capital word or words in that part of the sentence in which they will make the fullest impression. The fourth rule is to make the members of sentences go on rising and growing in their importance above one another; which kind of arrangement is called a climax (which see); in other words, a weaker alteration or proposition should never come after a stronger one; and when a sentence consists of two members, the longer should, generally, be the concluding one. The fifth rule is to avoid concluding sentences with an adverb, a preposition, or any inconsiderable word; because such conclusions are always withering and degrading. Besides particles and pronouns, any phrase, which expresses a circumstance only, always brings up the rear of a sentence with a bad grace. Another rule, relating to the strength of a sentence, is this: that, in the members of a sentence, when two things are compared or contrasted to each other, where either a resemblance or an opposition is intended to be expressed, some resemblance in the language and construction should be preferred; for when the things themselves correspond to each other, we naturally expect to find the words corresponding too. We might here add, that the sound, harmony, and easy flow of the words and members of sentences, contribute to promote their strength and effect. This rule comprehends the choice of words, and their arrangement; the order and disposition of the members, the cadence or close of sentences, and the sound of words as adapted to their signification. For the illustration and application of these rules, we refer to Blair's Lectures, vol. i. and Murray's Grammar, vol. i. See Style and Numbers.

STRENGTH and STRESS of Materials, in Mechanics, is a subject of very considerable importance, and one which, of all the branches of this useful science, is the least understood. We have, indeed, two or three distinct theories by different authors, for estimating the strength of beams, and other materials, according as they are placed in this or that position; but it unfortunately happens that we owe all these theories to men who have not themselves made any experiments, and have, therefore, no better foundation than mere hypotheses, and consequently are not only discordant among each other, but totally at variance with practical results. The authors to whom we more particularly allude in this place, are Galileo, James Bernoulli, Leibnitz, Euler, and Lagrange; names certainly of the first eminence as philosophical mathematicians, and whose respective investigations, while we only contemplate the analytical processes of them, are highly honourable to the genius and talents of their authors; but when we consider them with reference to their practical application, we are obliged to admit that they are almost entirely useless. Had the materials the properties these authors suppose, viz. that they were perfectly elastic in one case, or perfectly rigid and incompressible in another, then we should doubtless find the results such as have been deduced; but we know that, practically, none of these properties are found to have place. We know of no bodies either perfectly hard, or perfectly elastic; we know of no bodies that are either wholly
STRENGTH OF MATERIALS.

wholly incomprehensible, or inextensible; and, consequently, of none to which these theories will apply; being each founded upon some hypothesis, which necessarily involves one or other of these principles as their bases. There is, however, another class of men to whom we are indebted for many varied experiments; but not one of them, we believe, has ever attempted to establish any theory, as founded upon the facts which these experiments have established. Of the latter classes are more particularly to be distinguished Marotte, Parent, Belidor, Mulchenbroeck, and Buffon, particularly the latter, who, with Du Hamel, was employed by the French government in making experiments on a very considerable scale; but unfortunately M. Buffon conducted them rather as a natural philosopher than as a mathematician, and, therefore, did not deduce from them those useful practical results, which might a priori have been expected. Our countryman, Emerson, also made some experiments on the strength of various materials; but little confidence is, we believe, to be placed on his determinations. They appear to have been made in too gross a manner to be at all dependent upon, to form the groundwork of any calculations; as, in some cases, they nearly double the strength which has been found by other and more accurate experiments; while, in some, they make it not more than half. Thus, Emerson says, that a piece of oak, 1 yard long and an inch square, when supported at its two ends, bore, before breaking, 330 pounds; whereas Belidor makes the strength only 187 pounds; and we have repeated the experiments on several pieces of oak of the same dimension, and have found a very accurate agreement between them, and the mean given by the latter author, viz. 187 pounds. The direct strength of cohesion of the different woods given by Mulchenbroeck and Emerson are also much at variance with each other; and though we ought not perhaps, in such a case, to give our entire confidence to either, yet the care Mulchenbroeck appears to have taken, and the minuteness with which he describes the processes he employed, cannot but incline us to adopt his results, in preference to Emerson's, till some farther experiments have been made, that, from their number and accuracy, may inspire us with greater confidence. Such a course of experiments is now carrying on at the Royal Military Academy, Woolwich, by Mr. Barlow of that establishment; and as nothing will doubtless there be wanting to render the course complete, either with regard to the facts and the observations applied to the workmanship that may be required, the publication of them will doubtless be very interesting, as the means of supplying a great defideratum amongst the scientific engineers of this country. "This subject," says Dr. Robison, "is of so much importance, that in a nation so eminent as this for invention and ingenuity in every species of manufactures, and in particular so distinguished for its improvements in machinery of every kind, it is somewhat singular that no writer has treated of it in detail, which its importance and difficulty demand. The man of science, who visits our great manufactories, is delighted with the ingenuity which he observes in every part, the innumerable inventions which come even from the individual artificians, and the determined purpose of improvement and refinement which he sees in every work-shop. Every cotton-mill appears an academy of mechanical science; and mechanical invention is spreading from these fountains over the whole kingdom. But the philosopher is mortified to see this ardent spirit fo cramp'd by ignorance of principles, and many of these original and brilliant thoughts obscured and clogged with needless and even hurtful additions, and a complication of machinery which checks improvement, even by its appearance of ingenuity. There is nothing in which this want of scientific education, this ignorance of principle, is so frequently observed, as in the injudicious proportion of the parts of machines, and other mechanical structures; proportions and forms of parts, in which the strength and position are in no wise regulated by the strains to which they are exposed, and where repeated failures have been the only lessons."

Without entering here upon the subject of corpuscular attraction, and the law of cohesion which the particles of bodies observe, according to their different arrangements, a topic that would carry us far beyond the limits we can assign to this article, and on which, after all, so little factitious information is to be expected, we shall proceed to examine the different strains to which a body may be exposed, and its tendency to refit fracture, according to its magnitude, form, and position.

A piece of solid matter may be exposed to four different kinds of strain, viz.

1. It may be torn asunder by some force applied in the direction of its length; as in the case of ropes, lathetters, king-poles, tie-beams, &c.

2. It may also be crushed by a force applied in the direction of its length; as in the case of pillars, polls, and truss-beams.

3. It may be broken across by a force acting perpendicularly to its length; as in joists, levers, &c.

4. It may be wrenched or twisted by a force acting in a kind of circular direction at the extremity of a lever, or otherwise; as in the case of the axle of a wheel, the nail of a prief, &c.

On the direct Cohesion of Bodies.—The first of these strains is by far the most simple, as to its physical operation; though it is that of all others, perhaps, that comes least under the consideration of a mechanic or engineer; and when it is the subject of contemplation, if any former experiment can be had recourse to, it is sufficient for his purpose; as no possible cause can be ascribed, nor any reason offered, for supposing that, in such cases, the strength varies directly as the area of the section of fracture, and thus independent of the length or position; except, indeed, so far as the former may increase the weight or force, when the body is supported in a vertical direction, or in any other position where the weight of the body itself increases the pressure. The action of the portion of the body is equally liable to fracture, being throughout stretched by the same force. But this supposes a perfect uniformity of corpuscular action, or of the attraction of cohesion, which is probably not the case in any body in nature; and, therefore, as the longest body, may be supposed to offer the greatest diversity in this respect; it may hence happen that the longest body is the weakest, and it is probably to this circumstance we must attribute the popular notion of our mechanics, that a long rope is easier broken than a shorter one of equal quality and thickness. It is a fact perhaps drawn from experience, but it is one which cannot be introduced into the science of mechanics; for we must there suppose the body of uniform texture, and draw all our inferences from that source; and this obviously leads us to the above conclusion, viz. the strength of bodies, exposed to strains in the direction of their length, is directly proportionate to their transverse area, whatever may be their figure, length, or position.

As to the irregularities to which we have above alluded, they doubtless arise from a thousand circumstances, with which we are wholly unacquainted; in metals, it depends upon
STRENGTH OF MATERIALS.

Upon their purity, the heat at which they are melted, the moulds in which they are cast, the manner in which they are left to cool, and many others, which totally escape our observation, since they produce different degrees of cohesion between the particles, which, as far as our observation can extend, are circumstance in every respect in the same manner, being all blended in one mass, and indistinguishable one from the other.

It has been ascertained from experiment, that by forging a metal, or by frequently drawing it through a small hole in a steel-plate, its cohesion is considerably increased; a fact which, though it seems to be too simple a statement, appears to us to be perfectly reconciliable with what might be expected to have been expected in the increased density which this operation is known to produce. Admitting the parts to be placed at equal distances from each other, after wire-drawing or forging, as we suppose them to be before, their lateral distances will decrease as the cube root of their densities, and consequently the number that are brought in contact in equal sections, are as the 3d power of the density; the strength, therefore, ought to vary in the same ratio: as to the distances in the direction of the length, we do not conceive that it increases the strength; it may render the substance less liable to rupture in the first instance; but if, as in all probability the case is, the particles are ultimately removed to a greater distance before the fracture takes place, the same ultimate force will be requisite to separate the parts, however close the contact might be in the original state of the body; that is, when first submitted to the experiment.

We are unacquainted with the real increase of strength that may be obtained by the processes above alluded to; and more particularly with the lateral approach of the particles, which may be greater than would arise from a uniform distribution of them; and are therefore unable to say how far the increased strength agrees with what we have hinted may arise from the increased cohesion of the particles. Leads which is said to become harder by wire-drawing, has its cohesion tripled; gold, silver, and brass, have also their cohesion nearly tripled; and copper and iron have theirs more than doubled. How far these facts can be satisfactorily explained by the greater contiguity of the particles laterally, we cannot pretend to say, but it certainly will account for a considerable part of the increased strength.

Experiments on the direct cohesion of all bodies, and particularly metals, are attended with considerable difficulty, in consequence of the enormous weights that are required in producing separation in bars of any considerable dimension: we have, however, a few results of this kind, which we owe to Mülchenbroeck, and other experimentalists, the principal of which are contained in the annexed table, all reduced to the section of a square inch.

<table>
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<tr>
<th>Metals</th>
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<tr>
<td>Gold cast</td>
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<tr>
<td>Silver cast</td>
<td>24,000</td>
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<tr>
<td>Japan</td>
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<td>22,000</td>
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<td>Stavian</td>
<td>65,000</td>
</tr>
<tr>
<td>Bell Swedish and Russian</td>
<td>78,000</td>
</tr>
<tr>
<td>Horse-nails</td>
<td>71,000</td>
</tr>
<tr>
<td>Steel-bar</td>
<td>Soft</td>
</tr>
<tr>
<td></td>
<td>Razor-tempered</td>
</tr>
<tr>
<td></td>
<td>Malacca</td>
</tr>
<tr>
<td></td>
<td>Banca</td>
</tr>
<tr>
<td>Tin cast</td>
<td>Block</td>
</tr>
<tr>
<td></td>
<td>English block</td>
</tr>
<tr>
<td></td>
<td>English grain</td>
</tr>
<tr>
<td>Lead cast</td>
<td>8,600</td>
</tr>
<tr>
<td>Regulus of antimony</td>
<td>1,000</td>
</tr>
<tr>
<td>Zinc</td>
<td>3,500</td>
</tr>
<tr>
<td>Bismuth</td>
<td>2,000</td>
</tr>
</tbody>
</table>

It is very remarkable, that almost all mixtures of metals are stronger, or more tenacious, than the metals themselves, much depending upon the proportion of the ingredients, and these proportions are different in different metals. The following are some of those which Mülchenbroeck allerts to produce the greatest strength.

<table>
<thead>
<tr>
<th>Mixtures</th>
<th>lbs.</th>
</tr>
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<tbody>
<tr>
<td>Two parts of gold with one of silver</td>
<td>28,000</td>
</tr>
<tr>
<td>Five parts of gold with one of copper</td>
<td>50,000</td>
</tr>
<tr>
<td>Five parts of silver with one of copper</td>
<td>48,500</td>
</tr>
<tr>
<td>Four parts of silver with one of tin</td>
<td>41,000</td>
</tr>
<tr>
<td>Six parts of copper with one of tin</td>
<td>41,000</td>
</tr>
<tr>
<td>Five parts of Japan copper with one of Banca tin</td>
<td>57,000</td>
</tr>
<tr>
<td>Six parts of Chili copper with one of Malacca tin</td>
<td>60,000</td>
</tr>
<tr>
<td>Six parts of Swedish copper with one of Malacca tin</td>
<td>62,000</td>
</tr>
</tbody>
</table>

These results are very useful, provided they could be securely depended upon; but we could wish to see similar experiments repeated by other philosophers: not that we wish to undervalue the labours of Mülchenbroeck, to whom the arts are much indebted for many valuable deductions, but much irregularity takes place in experiments of this kind, that it is only in a multiplicity of them, complete accuracy, or even an approach towards it, is to be obtained.

The gun-founder might derive considerable information from a well-directed course of experiments of this kind, as well as the plumber and engineer; it appears from the above, that a mixture of copper, whose strength does not exceed 37,000 lbs., with tin, whose strength is 60,000 lbs., is a mixture produced, whose strength is from 60,000 lbs. to 64,000 lbs., at the same time that it is harder, and easier wrought; and as to the objection that has been advanced against it, of being more fusible, we refute it nothing more than a false idea arising out of a very common error, that field-ordnance is liable to become fusible with rapid firing: we have been informed by very experienced artillery officers, that nothing of this kind ever happened, the damage which the piece sustains at the muzzle being merely due to the rubbing and knocking of the ball in its passage out of the gun.

Having said thus much with regard to the direct cohesion of metals, we must now attend to another very important subject; viz. the strength of timber.

The cohesion here is probably of a very different kind, and subject even to more inequalities than that of metals; much depends upon the soil where the tree grows, and a considerable difference is found between different parts of the same tree;
STRENGTH OF MATERIALS.

The wood immediately surrounding the pith or heart of a tree, is said by some to be the weakest, particularly if the tree is old; others, especially Buffon, affirm the contrary; the fact probably is, that up to a certain age it is strongest at the heart, but that afterwards these parts become weaker, or begin first to feel that decay which ultimately pervades the whole. In many experiments which we have made, we have always observed that the heaviest pieces (and there is a very considerable difference in this respect in different parts of the same tree) are the strongest; and, generally speaking, the part nearest the centre and towards the root has the greatest specific gravity.

1. The wood of the north side of all trees in our climates is said to be weaker than that of the south, and the south-east side the strongest: we are, however, much inclined to doubt the fact, as it relates to forest-trees. In trees particularly situated, with regard to exposure on one part more than another, something of the kind may have place; but trees in a forest, which experience very little difference in this respect, we are inclined to think, from some observations, have but a slight difference of strength depending upon their northern or southern direction. It is true, generally, that that wood is the strongest whose annual plates are thickest, the ligneous fibres being stronger than the trachea, or air-vessels; and, therefore, the more of the fibrous parts there are contained in any given dimension, the greater is the strength: but this is much more obvious in some woods than in others, and most of all, perhaps, in ash, in which we have seen a very remarkable difference in this respect. In very close-grained wood it is scarcely perceptible.

The only author who has enabled us to judge of the accuracy of his experiments is Murchenbroeck, who has described very minutely his apparatus, and his method of performing the experiments. The pieces employed for this purpose were parallelepipedons, cut down in the middle to 1/4 of an inch square, or 1/16 of an inch section. These results, reduced to the section of a square inch, are as follow:

<table>
<thead>
<tr>
<th>Wood</th>
<th>Lbs.</th>
</tr>
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<tbody>
<tr>
<td>Locust-tree</td>
<td>20,100</td>
</tr>
<tr>
<td>Juteb</td>
<td>18,500</td>
</tr>
<tr>
<td>Beech oak</td>
<td>17,300</td>
</tr>
<tr>
<td>Orange</td>
<td>15,500</td>
</tr>
<tr>
<td>Alder</td>
<td>13,900</td>
</tr>
<tr>
<td>Elm</td>
<td>13,600</td>
</tr>
<tr>
<td>Mulberry</td>
<td>12,500</td>
</tr>
<tr>
<td>Willow</td>
<td>12,500</td>
</tr>
<tr>
<td>Ash</td>
<td>12,000</td>
</tr>
<tr>
<td>Plum</td>
<td>11,800</td>
</tr>
<tr>
<td>Elder</td>
<td>10,000</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>9,750</td>
</tr>
<tr>
<td>Lemon</td>
<td>9,350</td>
</tr>
<tr>
<td>Tamarind</td>
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<tr>
<td>Fir</td>
<td>8,530</td>
</tr>
<tr>
<td>Walnut</td>
<td>8,330</td>
</tr>
<tr>
<td>Pitch-pine</td>
<td>7,650</td>
</tr>
<tr>
<td>Quince</td>
<td>6,750</td>
</tr>
<tr>
<td>Cypresses</td>
<td>6,000</td>
</tr>
<tr>
<td>Poplar</td>
<td>5,700</td>
</tr>
<tr>
<td>Cedar</td>
<td>4,880</td>
</tr>
</tbody>
</table>

Emerson, in his Mechanics, gives us also a series of results, but they are unlike the former, as they do not exhibit the utmost strength, but what may be safely suspended on a square inch; yet as we may presume that each of those weights are in the same proportion to the greatest strength, they ought to enable us, in some measure, to compare the relative strengths of the different woods given by these two authors. Emerson's table is as follows; viz.:

<table>
<thead>
<tr>
<th>Wood</th>
<th>Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak, box, yew, plum-tree</td>
<td>7850</td>
</tr>
<tr>
<td>Elm, as, beech</td>
<td>6070</td>
</tr>
<tr>
<td>Walnut, plum</td>
<td>5350</td>
</tr>
<tr>
<td>Red fir, holly, cedar, plane, crab</td>
<td>5000</td>
</tr>
<tr>
<td>Cherry, hard</td>
<td>4760</td>
</tr>
<tr>
<td>Alder, as, birch, willow</td>
<td>4290</td>
</tr>
</tbody>
</table>

With regard to the absolute results in these two tables, we do not, of course, look for uniformity; the one exhibiting the ultimate strength, and the other the weight which a rod of an inch square may support with safety: but in the relative strength of the different woods, some coincidence might have been expected; we find, however, considerable difference in this respect. The latter author gives us no particulars, and we are therefore rather inclined to give the preference to the former, who has been very minute in his description, as well as careful in making the experiments; yet some sublunary experimentalists have not been able to find equal strength: thus M. Petit fays on the authority of his own observations, that the strength of oak is 17,500 lbs.; whereas Murchenbroeck makes it 17,300 lbs.; and we must add, in confirmation of the former, that in the experiments to which we have before adverted, as at this time in progress at the Royal Military Academy, Woolwich, the strength of oak has been found but little exceeding 9000 lbs.; the specific gravity of it being 774. We have not this datum in either of the above cases; yet we conceive it to be a very important one, as we have always found the strength of wood of the same thickness, to depend a great deal upon its weight and specific gravity. The former experiments give for the strength of ash 17,000 lbs., and fir from 15,000 lbs. to 13,000 lbs., both considerably different from Murchenbroeck's tabular results.

On the Resiliency of Bodies, when pressed longitudinally.

It is obvious that a body, when pressed endwise, by a sufficient force, may be crushed and destroyed; and this may take place, either by a total separation of the matter of which it is composed, or by bending it, whereby it is broke across: if the length or height of the body is very inconsiderable with regard to its other dimensions, the former is the almost certain result; but if its length be much more than its breadth and thickness, it generally bends before breaking, and in this case the operation is not very different from what takes place in beams supported at each end, and loaded in the middle; a subject which will be treated of in a subsequent part of this article. We have some very intricate analytical investigations on this subject by Euler and Lagrange. These authors have both treated the problem on the principles first promulgated by James Bernouilli, in his investigation of the properties of the elastic curve; but as we doubt very much whether they can be applied to any useful practical operations, we must beg to pass them over in this place, by merely referring such of our readers who are desirous of consulting the investigations of these two very able mathematicians, to the original works. Euler's first memoir will be found in the appendix to his "Methodus inveniendi
STRENGTH OF MATERIALS.

inveniendi lineas curvas maximi et minimi, &c." 1744.
A second memoir is published in the Berlin Transactions for
1757, and a third in the Acta Petro. 1778. Lagrange's
papers are given in the Turin Memoirs for 1770-1, and in the
Memoirs of Berlin for 1769.

As to the experiments that have been made on this kind of
strain, there are few from which much practical information
may be obtained. M. Petit says, that his experiments,
and those of M. Parent, shew that the force necessary for
crushing a beam is not equal to that which will tear it
asunder. He says that it requires something more than 600
on any square line of sound oak to crush it. But experi-
ments made on such small pieces cannot be depended upon ;
and when they are made on pieces of greater dimensions, the
weights become so enormous, as to render them nearly im-
practicable; it is therefore fortunate that we have little oc-
casion for very accurate information on this head: what is
more defirable to be acquainted with is, the resistance which
a pillar or post will offer to compression before bending; the
length being taken into consideration; for it is obvious, both
from theory and practice, that the length of the beam must be an important datum in
this kind of strain, although it is not in the former, vis. in
opposing being drawn asunder; it is therefore very defective to
state the requisite forces in both cases to be equal, or in
fact to state any proportion whatever between them.

M. Girard, in his "Traité Analytique de la Réistance
des Solides," Paris, 1796, details a great variety of ex-
periments made on beams of fir and oak of considerable di-
ensions, by means of a certain machine constructed for the
purpose. But as these experiments were not made so much
with a view of breaking the pieces submitted to the presure,
as to measuring their deflections, and estimating what the
author calls, after Euler, their absolute and relative elas-
ticity; they do not furnish us with the kind of results above
alluded to, as having been attempted by MM. Petit and
Parent.

Through the whole course of M. Girard's experiments,
much irregularity was observed, so much, indeed, as to ren-
der it very doubtful whether any number of experiments
could furnish us with certain and conclusive results; and if
experiments fail in this respect, it is wholly useless to look
to any assistance from long and laborious analytical in-
vestigations. The following table contains many of the most im-
portant experiments of this author on oak-beams; the first
column registers the number of the experiments; the second,
third, and fourth, the length, depth, thickness, and weight of
the beams; the fifth and sixth the distance of the greatest
deflection from the bottom or foot of the beam; the former in
the direction of the greatest thickens or depth; and the
latter in the direction of the less thickens or breadth; the
seventh and eighth columns contain the measure of the greatest
deflection, or vered line of the curve; the former of the depth,
and the latter of the breadth; the ninth column exhibits the
weights under which the several deflections were observed,
and the tenth and last column the time between the first
weight being applied and the observation. It should be ob-
erved, that M. Girard has given several more measures of
deflections, weights, &c. than we have copied; we have, in
all cases, taken his third and last two, and omitted the
intermediate ones.

The experiments marked with an asterisk broke under the last
registered weight; the others did not, and most of the latter

nearly recovered their original form after being unloaded for
some hours. The deflections marked + and — are those in
which the beam took a double curvature.

The other experiments of this author (the details of which
occupy nearly 50 quarto pages) were made on the trans-
verse strain, or rather on the deflection caused in beams by
loading them in the centre with different weights, their ex-
tremities being supported on two props.

The oak-beams were the same which had been submitted
to the longitudinal pressure, as exhibited in the following
table, and which were not broken in those experiments;
the third table contains the results of similar experiments on
fir-beams of larger dimensions; and the two subseqent

tables, similar ones on what the French workmen call bois
de brin, that is, pieces which have been simply squared from
the branches, or trunk, corresponding with what our work-

men call &c.

In all these cases, the deflection was found to follow very
nearly the ratio of the weights with which they were loaded,
multiplied by the square of the length of the piece, and to
be inversely as the square of the depth into the breadth.
The fir-beams gave much more uniform results than those of
oak, which is accounted for from the more regular and
uniform organization of the former wood.

M. Girard endeavours to connect the results with those
on the longitudinal pressure, for which purpose he gives us
the following formulae, vis. let \( f \) denote half the length
of a beam, supported at each end and loaded in the middle, and
let \( h \) half that weight be denoted by \( P \), and \( b \) the quantity
of the beam's deflection; also \( 
\frac{\pi^2 E k b}{4 f^2} \)
and the weight \( Q \), under which the same beam will begin
to curve, when pressed endwise, will be expressed by

\[
Q = \frac{\pi^2 E k b}{4 f^2},
\]

or, by substituting for \( E k b \), we have

\[
Q = \frac{\pi^2 P f}{12 b}.
\]

We cannot, however, say how far this formula will ap-
ply, it being very difficult to ascertain the commencement
of deflection in the actual experiment.

M. Girard gives us also two other formulae, for estimating
the deflection of oak and fir beams, when loaded in the mid-
dle by a weight, and supported at each end, vis.

\[
\frac{P f^3}{3 b} = (11784451)(f + 0.3) a b^2
\]

for oak,

\[
\frac{P f^3}{3 b} = (8161128) a b^2
\]

for fir,

where \( P \) is half the weight, \( f \) half the length, \( b \) the deflec-
tion, \( a \) the depth of the beam, and \( b \) its breadth.

These apply only to rectangular beams; and, in order
to render them general, the author uses the principles of
Leibnitz, whereby the errors of the latter are connected with
them in such a manner as to render the formula entirely
utile for practical cases.

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## STRENGTH OF MATERIALS.

Girard’s Experiments on Oak-beams, pressed in the Direction of their Length.

<table>
<thead>
<tr>
<th>No. of Expt.</th>
<th>Length in Metres</th>
<th>Depth in Metres</th>
<th>Breadth in Metres</th>
<th>Weight in Kilograms</th>
<th>Height of Deflection from the Foot in Metres</th>
<th>Vertical Sine of greatest Deflection</th>
<th>Weight in Kilograms</th>
<th>Time in Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
<td>In the Direction of its Depth</td>
<td>In the Direction of its Breadth</td>
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* deflections not observed.
## STRENGTH OF MATERIALS.

### Table—continued.

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<th>Breadth in Metres</th>
<th>Weight in Kilograms</th>
<th>Height of Deflection from the Foot in Metres</th>
<th>Verted Sine of greatest Deflection</th>
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STRENGTH OF MATERIALS.

The reader will perceive considerable irregularity in many of the above experiments, both with regard to the height at which the deflection begins, the quantity of it, and its direction; being sometimes in the line of the greatest thickness, and sometimes in that of the leaf, but more commonly in both. It will also be observed, that some of the beams broke under less pressure than others, of the same or less dimensions, bore without any apparent injury.

We cannot enter here into a farther explanation of the experiments, nor shall we attempt to illustrate the theory which the author seems desirous of establishing, both because it would carry us beyond our limits, and that, at the same time, we are very doubtful of its accuracy. When the only deduction is a mean drawn from a great variety of very irregular results, it is of little use to the practical engineer. He had much better be furnished with the several experiments, and thence form his own judgment of what dimensions will best suit his purpose, according to the particular object he may have in view; and in this respect, vis. in the detail of the experiments, rather than in theory deduced from them, we ought to esteem the value of this author’s labours, which have been very great, and are deserving of high commendation.

The only experiments, besides the above, that appear entitled to any notice, are those of M. Gaunthez, in the fourth volume of Rozier’s Journal de Physique.

This engineer exposed to great pressures small rectangular parallelepipeds, cut from a vast variety of stones, and noted the weights which crushed them. The following table exhibits the medium results of many trials, on two very uniform kinds of free-stone, one of them among the hardest, and the other among the softest, used in building.

The first column contains the length, the second the breadth, and the third the area, of the section, in lines, or twelfths of inches; the fourth is the weight in ounces which crushed the stone; and the fifth the whole numbers, which nearly expresses the number of ounces borne by each square line.

<table>
<thead>
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Very little can be deduced from these experiments. The first compared with the third, and the fifth with the sixth, should furnish similar results; for the first and fifth are respectively half of the third and sixth, but the third is three times stronger than the fifth, while the sixth is only double the strength of the fifth.

In all these results, the strength increases faster than the area of the section, and that a square line can carry more and more weight, as it is a part of a larger surface; but in the experiments on the soft stone, the strength seems to increase more nearly in proportion to the surface.

These experiments are doubtless upon too small a scale to be of any essential service to the practical engineer: the pieces of stone ought certainly to have had a square inch of surface at least, and the weight which would have been necessary to crush them would not have been so enormous, but that some very simple mechanical apparatus might have been made sufficient for the purpose; and if any tolerable uniformity were observed in pieces of that size, some useful conclusions might possibly be drawn from the experiments.

But we think little confidence can be placed in those made on pieces of such small dimensions. According to M. Gaunthez’s deductions, a pillar of hard stone of Givry, whose section is a square foot, will bear with perfect safety 664,000 pounds; and its extreme strength is 871,000 pounds; and the leaf, as observed in his experiments, 460,000 pounds. The soft bed of Givry stone had for its least strength, on the same surface, 187,000 pounds; for its greatest, 311,000 pounds; and for its safe load, 240,000 pounds.

Good brick will carry with safety 320,000 pounds, on a free foot; and chalk, 300,000 pounds.

Besides the above experiments on the force necessary for crushing stone pillars, M. Gaunthez made others on their strength of direct cohesion, as well as on the transverse strain. He found that a prism of hard Givry stone, of a foot section, was torn asunder by a weight of 4500 pounds; and that, when firmly fixed in a horizontal wall, it will be broken by a weight of 56,000 pounds, suspended at the distance of twelve inches from its junction; and, if it rests upon two props, a foot distant from each other, it requires 365,000 pounds laid on its centre to produce the fracture.

We shall merely observe here, that these results are very inconsistent with each other; and that some mistake, or some very unaccountable irregularity, must have taken place in the experiments, that it should require so much more weight, acting at the distance of a foot, to produce the separation, than when the force acted at no mechanical advantage whatever, as in the case of direct cohesion.

Very different to the above have been the results of such experiments as we have performed on different kinds of wood. An oak rod of an inch surface requires a weight of about 9000 pounds to produce the fracture; while the same, or a similar rod, fixed in a wall, and acted upon at the distance of a foot, is broken with a weight of 152 pounds, and sir, which will bear 13,000 pounds on a square inch, suspended vertically, is broken with a weight of 136 pounds.

We are aware, that in different materials, a different law may be observed between the strength of direct cohesion and the resistance of the same body to a transverse strain; but it is absolutely impossible to have the difference stated by M. Gaunthez. A good course of experiments is, therefore, much wanted on materials of this kind.

We ought perhaps to observe, that we have not had an opportunity of consulting the work in which M. Gaunthez’s experiments were originally given. Our numbers are drawn from Dr. Robison’s account of them, in the work to which we have before referred.

On the transverse Strain and Strength of Beams, &c.—The most usual strain, and, therefore, the one with which it is most important for us to be well informed, is that by which a body is broken across, from the action of a weight being perpendicularly or obliquely to its length, while the beam itself is supported at its two extremities, or by one end and being firmly fixed in a wall, or other solid and immovable body. Galileo, to whom the physical sciences are so much indebted, was the first who connected this subject with mathematical principles, and endeavoured to trace the law of strength which different bodies possessed, in proportion to their length, breadth, depth, form, and position. It appears that this philosopher was led to these observations, in consequence of a visit that he made to the arsenal of Venice, and the results of which were published in his Dialogues in 1635. Galileo supposed solid bodies to be composed
composed of small fibres applied parallel to each other, and
fought, or assumed, at first, the force with which they re-
flitted the action of a power to separate them, applied
parallel to their length; and thence readily deduced that
their reftaintse, in this direction, was directly as the area
of the transverse perpendicular section, that is, to the num-
ber of fibres which compose the body. He then consider-
ed in what manner the same fibres would oppose a force ap-
plied perpendicular to their length; and concluded, that
when a beam is fixed horizontally in a wall, the reftaintse
of the integral fibres is proportional to their sum, mul-
tiplied into the arm of a lever, which is always a certain
part of the vertical dimension of the solid in its plane or
area of fracture. This general principle is, in fact, adopted
by most writers on this subject; but that which is peculiar
to Galileo is, that he supposed the reftaintse of each fibre
to be the same, and, therefore, in a wholly independent
of their quantity of extension at the moment of rupture.
Supported on the result of these reftonings, and guided by
the genius for observation, which he possessed in an eminent
degree, he illustrated many of the proceedings of nature,
which the more ancient philosophers had left unnoticed;
as well as certain anomalies, or which then appeared as such,
in the works of art. To some of his observations on this sub-
ject we may have occasion to advert, in a subsequent part
of this article; but at present we shall confine ourselves
to the illustration of his particular theory. It will be pro-
bably seen, however, that a few of the terms which more
commonly occur in the course of our investigations.

We have already explained what is to be understood
by the absolute strength of a body, or its strength of direct
cohesion; viz. the number of pounds weight necessary to
produce a fracture of its parts, when applied in a direction
parallel to its length.

And as to the words strength, stress or strain, they are
used, the former to denote the force or power with which
any mass or body reftills a breach or change in its state,
which a pressure or stroke upon it has a tendency to pro-
duce; and the latter are used indiscriminately to express the
force which is exerted on any such mass, and tending to
break it. Thus, every part of a pillar is equally strained
by the load which it supports; and hence it is evident that
we cannot make any structure fit for its purpose, unless the
strength, in every part, be at least equal to the stress laid
on, or the strain exerted in that part; and hence the ne-
cessity of an acquaintance with the nature of the reftaintse
of bodies, in order that we may not have our structure deficient
in strength, nor over-burdened with useless materials; which
latter, carried to excess, may be the cause of producing the
mischiefs they were intended to prevent.

In order to illustrate the theory of reftaintses of bodies,
when exposed to a transverse strain, according to the hy-
pothesis of Galileo, let RSTV, (Plate XXXIX. Meth-
ematics, fig. 1.) represent a solid wall, or other immoveable
mass, into which the beam, C G, is inserted; and let W
represent a weight sufficient from its other extreme-
ity. Then supposing the beam to be inerupably strong in
every part, except in the vertical section A B C D, the
fracture must necessarily take place in this section only,
and, according to the hypothesis of this author, it will
turn about the line C D, whereby the fracture, commen-
cing in the line A B, will terminate in the former, C D.
Galileo also further supposes, that the fibres, forming the
central horizontal plates or lamina from C D to A B, act
with an equal force in refilling the fracture, and, therefore,
differ in their energy only as they act at a greater or less
distance from the fulcrum C D. Now, from the known
principles of the lever, it is obvious that the equal forces
acting at the several distances o a, o b, o c, o d, &c. of the
lever o, will offer reftaintses proportional to their respective
distances; and, therefore, that the sum of all these re-
ftaintses, that is, of the confluent forces, of each particle
into its respective distance, is the force which must be over-
come by the weight W, acting at the distance o K.

This will, perhaps, be better understood by referring to
fig. 2, where A C I F represent a section of the beam C G,
and r, r', r", &c. are so many small equal weights acting
at the several distances C M, C M', C M", &c.; then denoting
each of these weights by the constant quantity f, the sum of
all their energies or reftaintses will be expressed by A C
.+ C M f + C M' f + C M" f + &c. = f x (A C +
C M + C M' + C M" + &c.) This, however, supposes the
section A C D B (fig. 1.) to be rectangular or that the
number of fibres in each horizontal lamina are equal in
number. When the beam is triangular, cylindrical, or
having any other than a rectangular section, the several
small weights must be proportional to the breadth of the
section at the point where it is supposed to act: the illus-
tration, in this case, however, is equally obvious.

Since then the whole reftaintse to fracture is made up of
the sum of the reftaintses of every particle or fibre acting at
different distances on the lever C A, which is supposed to
turn upon C as a fulcrum, there must necessarily be some
point in that lever, in which, if all the several forces were
united, their reftaintse to the weight W would be exactly
the same as in the actual operation, and this point is the cen-
tre of gravity of the section, as is readily demonstrated as follows.

Let A B C (fig. 3.) represent the section of any beam
whatever, F H any variable abscissa = x, and D E the cor-
responding double ordinate = y; then, by what is stated
above, the energy, or force, of all the particles in the line
D E, will be as D E x F H, or as x y, and consequently
the fluxion of that force will be y x x, and therefore the
sum of them = f y x x, or fluxion of y x x; also y x = area
A B C; whence, assuming G to be the centre of energy
fought, we must have F G x f y x = f y x x, whence

F G = f y x x
f y x,

which is the well-known formula for the centre of gravity.

Hence refults the following very simple theory for the
strength of beams placed firmly in a solid wall, or other
immovable body; viz. that "the weight necessary to pro-
duce the fracture, is to the direct force of cohesion of all
the fibres in the section, as the distance of the centre of
gravity of that section from the point where the fracture
termimates, to the length of the beam, or distance of the
weight from the same point."

Nothing more simple can be defined as a general theory,
but unfortunately it is founded on hypotheses which have
nothing equivalent to them in nature: in the first place, it
assumes the beam to be inerupably strong, and inerupably
strong, except at the section of fracture; secondly, that the fibres
are inextensible and incompressible; and thirdly, that the
beam turns about its lowest point, when fixed at one end,
or its upper, when supported at both; and, consequently,
that every fibre in the section is exerting its force in refilling
extension; and, lastly, (if this be not implied in our second
objection,) that every fibre acts with equal energy, what-
ever may be its quantity of extension. Now, with regard
to the fist of these suppositions, it is obvious that no beam of
timber, nor any other body, is perfectly inerupably strong; nor
STRENGTH OF MATERIALS.

any (and more particularly timber) whose fibres are not both extensible and compressible; and, consequently, a beam of such matter will not turn about its lowest point as a fulcrum; and, lastly, the supposition of every fibre exerting a centesimal restance, independently of its quantity of extension, if it be not incorrect, is of that nature which ought not to be assumed, without first being verified by experiment. Such being the inaccuracy of Galileo's hypothesis, it necessarily happened, as soon as it was attempted to compare it with experiments, (which the author himself had never done,) that it was found defective. The first, we believe, who did this was Mariotte, a member of the French Academy in 1680; and what he published on the subject engaged the attention of many celebrated mathematicians of that day, particularly Leibnitz; who, after examining the theory of Galileo, published his own thoughts on the subject. He had frequently remarked that the rupture of a body, whatever it may be, is always preceded by a certain degree of inflection, from which he concluded, contrary to the former opinion, that every body was composed of extensible fibres, and asuming the principle first laid down by Dr. Hooke, viz. "ut tenso farcis," he concluded that every fibre, instead of acting with an equal force, exerted a power proportional to its quantity of extension, or, which is the same, proportional to its distance from the line about which the beam was supposed to turn; but he still considered the fibres to be incompressible, and consequently that the beam turned about its lowest point. Thus, to use a similar illustration in this case that we have done in the former; instead of the fracture being opposed by the action of the equal weights at r, r', r", r"', &c., as in fig. 2, the re-action was supposed to be equal to the several equally decreasing weights at r, r', r", r"', &c., &c. The only alteration which this new supposition introduced into the final result was, the removal of the centre of energy, C, to a point nearer or farther from the centre of motion, according to the figure of the body; and this new point is found to be distant from that axis, by a quantity equal to the product of the distances of the centre of gravity, and centre of oscillation of the area of fracture, from the axis of motion, divided by the depth of the section.

For let ABC (fig. 3.) represent the section of fracture on any beam; F H = x, any variable abscissa; and D E = y, the corresponding double ordinate; allo make C F = d, and let f represent the absolute and ultimate force of a fibre at C, in the moment of rupture; then, since the force of each fibre is supposed to vary as its extension, or as its distance from F, we have:

\[
\frac{f y' y}{d} = \text{the force of a particle at H; and the number of particles acting at this distance being } y, \text{ we shall have } \frac{f y' y}{d} \text{ for the sum of the forces of all the fibres in the line D E; but this force, acting upon the lever at the distance H F, its resistance will be } \frac{f y' y}{d}, \text{ and hence the sum of all the restances of every fibre in the section will be } \int \frac{f y' y}{d} \text{; now this is to be equal to the direct cohesion of all the fibres acting at some required distance F I; that is, } F I \times \int \frac{f y' y}{d}, \text{ an expression which is exactly equivalent to the general expression } \int \frac{f y' y}{d}, \text{ for the centre of oscillation of a body, multiplied by } \frac{f y' y}{d}, \text{ the general expression for the centre of gravity, divided by } d. \text{ Hence, as these centres are known in most bodies which come under our consideration in the present subject, it will be useful to avail ourselves of them in determining what may properly be called the centre of energy, or centre of tension.}

This being the case, both theories gave the same results, so far as related to the comparison of the strength of similar beams, but of different dimensions; thus, from both, it was shown, that beams of the same depth and breadth were to each other, in point of strength, inversely as the length; that when the length and depth were the same, the strength varied as the breadth; when the breadth and length were the same, the strength was directly as the square of the depth; deductions which have been found to agree very nearly with experiment. There were, however, some expressions arising out of these two hypotheses which were totally irreconcilable with each other. In the first place, although the proportions were the same, the absolute strength in the one case, was to that in the other as 2 to 3, in rectangular beams; and in triangular beams, the disagreement was still more striking; also, according to Galileo, the strength of a triangular beam, with its edge upwards, was to the same with its base upwards, as 1 to 2; and, according to Leibnitz, as 1 to 3; whereas, as we have found from numerous experiments, it is stronger in the former position than in the latter, at least in woods of some kinds, and probably in all.

These anomalies led James Bernoulli to investigate the question de novo. This philosopher observed, that at the instant a body is broken across by a transverse strain, such as we have all along supposed, a part of the fibres is in a state of extension, as assumed by Leibnitz, and a part in a state of compression, a circumstance which had not before been introduced into the consideration of the question: he moreover doubted of the propriety of the principle, ut tenso fic vis, employed by Leibnitz, and made some experiments, whereby he proved that this is not, at least, a general principle; but the only effect of his observations and experiments went no farther than proving that Leibnitz's theory was inadmissible, for he substantiated no other in its place, except so far as his theory of the elastic curve (a problem which grew out of the present question) may be considered as applicable to this subject; had he pursued the idea he seems first to have promulgated, of a part of the fibres being compressed, and a part in a state of tension, and consequently that the line about which the beam turns is somewhere within the area of the section of fracture, we might have expected, from his extraordinary talents, a complete solution of this very interesting problem; instead of which, he contented himself with stating a few general observations, and pointing out the difficulty of the determination of the neutral axis, or of that line which sufers neither compression nor extension, which is the principal desideratum for establishing a correct theory; and in that state he left the question, and in that state it has ever since remained.

The only other attempt, that we know of, at establishing a new theory, is that given by Dr. Robison, under the article Strength, in the Encyclopaedia Britannica. This author
STRENGTH OF MATERIALS.

The author has taken into his consideration the areas of compression and of extension; but for want of experiments, is unable to assign the position of the neutral axis: we suspect, also, an important error in the principle which he has laid down, viz. that notwithstanding the beam really turns about what he properly calls a neutral axis, yet that in our investigation, we must compute the effect of the rotation, as if it was made about the centre of compression. We were much struck with the singularity of this assertion, and have, we believe, proved its fallacy in various experiments.

There is no doubt, from various experiments, and particularly from those of Du Hamel, when a piece of timber is submitted to the transverse strain we are considering, that only a part, and probably but a small part, of the whole number of fibres, has a tendency to refit the fracture by means of their tension, while the rest of the fibres act merely from their resistance to compression. Du Hamel was, we believe, the first author who demonstrated the fact by experiment. He took eighteen bars of willow, two feet long, and half an inch square, and supporting them by props under their ends, he broke them by weights hung on their middle. Four of them broke with the weights 40, 41, 47, and 53 pounds, the mean of which is 45. He then cut four others of them through one third of their depth on the upper side, and filled up the cut with a thin slip of harder wood, stuck in pretty tight. These were broken with weights of 48, 54, 52, and 50 pounds, the mean of which is 51. He then cut four others half through, and these required 47, 49, 50, and 46 pounds to break them, the mean of which is 48; the remaining four were cut to two thirds of their depth, and their mean strength was 42 pounds.

In another set of his experiments we have the following results, viz.

Six bars of willow 36 inches long, and 1/2 inch square, were broken at a medium with 525 lbs.

Six bars cut one-third through, and the faw-cut filled up with a slip of hard wood, stuck in, broke with 557 lbs. at a medium.

Six bars cut half through, and the cut filled up in the same manner, broke 442 lbs. before the fracture; and

Six others cut three-fourths through, broke with 530 lbs.

A batten cut similarly to the latter, that is to say, three-fourths through, when nearly broken, being unloaded, and a thicker slip put into the cut, in order to fill up the part which had been compressed, so as to bring the batten straight again, but without straining it, broke afterwards 577 lbs.

It will be remarked, that in these experiments the bars appear to have been stronger after being cut one-third through, than when whole; and even when cut half through, they still bore more than when they were entire. This seems to have arisen from the faw-cut being filled up with a harder wood, which rendered the beam stiffer than when in its natural state, by opposing a greater resistance to compression; and this may account for his beams being nearly as strong when cut three-fourths through, as when whole, as we have reason to believe, that there are very few woods, if any, in which the neutral line lay so near as within one-fourth of the bottom. We have made similar experiments on fir, and some other kinds of wood; and found that some beams of fir, 30 inches long, 2 inches deep, and 1 inch thick, broke with 882 lbs. 871 lbs. 852 lbs. respectively, the mean being 864 lbs. We then cut three other similar beams five-eighths through, and having filled up the cut with slips of pear-tree, found their strengths equal to 808 lbs., 846 lbs. and 835 lbs. of which the mean is 830 lbs.; these proved that the neutral line was nearer the bottom than three-eighths, because the pear-tree wedges, being softer than the fir, the deflection of the beams was throughout greater, which shewed that they had loft in stiffness by the cutting; whereas Du Hamel's beams had gained stiffness from the circumstance of being filled up with wood harder than themselves: after all, however, this kind of experiment is not the best calculated for detecting the position of the neutral axis.

From what has now been stated, it is very obvious, that the theories both of Galileo and Leibnitz must be extremely defective, so far at least as they propose them to be employed in ascertaining the absolute strain that a beam will bear, when acted upon transversely by any weight, whether as supported at its ends, or by having one end fixed in a wall, as we have hitherto supposed. And as to the theory which Dr. Robison has advanced in the place above referred to, although it doubtless approaches much nearer to the truth, it is still, we conceive, incomplete; first, for want of experiments, from which alone the neutral axis can be determined; secondly, because he has not affixed the law of compression and tension, which is necessary for determining those centres in the section of fracture; and thirdly, because (as we have before stated) he supposes the rotation to be made about the centre of compression, instead of its being made about the neutral axis, and assigning the whole resistance to fracture to the extended fibres, instead of considering one half of it as due to compression and tension respectively. It is true that this may make no difference in the results, while we confine our investigation to rectangular beams, but it makes an important difference in triangular and other formed beams; in which cases, although it agrees better with experiment than the theories of either Galileo or Leibnitz, it is still very defective, as it gives greater strength to beams of a certain form, and in certain positions, where experiment shews them to be the weakest.

We cannot submit any of the formulæ of this author to consideration, as they are merely general symbols, in which the indeterminate letters are to be supplied by numbers drawn from experiments; but in the two former, the expressions are determinate, and they may therefore be submitted to calculation, and the results compared with those that have been drawn from actual experiment; but before we proceed to this comparison, it will be proper to consider the relative strains that a beam is subject to, according to the manner in which it is supported; a consideration that is independent of any particular theory of resistances, and one in which different authors have come to very contradictory conclusions.

1. A beam having one end firmly fixed in a solid wall, will bear the same weight at its extreme end, as if the beam passed through the wall to the same length, and was loaded by an equal weight at its other end; its bearing in the wall being in the latter case supposed to be reduced theoretically to a line, and practically to such a bearing as will not damage the beam by cutting it. Fig. 6.

This will be evident to such of our readers who are conversant with the laws of motion, and who are familiar with the idea, that "action and re-action are equal and contrary," but to others it may not be amiss to offer a few observations, by way of illustration.

Let A P C, and A' P' C', (fig. 7) be two detached levers, supported on the props P, P'; and let us suppose their ends at C, C', to be held towards each other by a rope or cord C C'.
STRENGTH OF MATERIALS.

C C. Now if we suppose the lever A P C' to be fixed by any means to the position shown in the figure, while the other lever, A P C, is loaded with the weight W, and free to turn about P, the cord or fibre C C' will be stretched exactly in the same manner as the fibre at C (fig. 6.), when the beam is fastened foldy in the wall; and if, instead of supposing the first lever, A' P' C', to be fixed, we now suppose it loaded with a weight W' = W, and free to turn about P'; then the fibre C C' will be in all respects circumjacent like the fibre at C (fig. 6.), when the beam is supped to pass through the wall, and a weight W' = W, acting in the direction A' P', will be produced.

But it is obvious that in fig. 7, the tension of the cord or fibre is the same in both cases; the only difference being, that the re-action of the fixed lever A P C', in the first instance, (and which is exactly equivalent to the force or energy of the weight W,) is, in the second, supplied by the action of an equal weight acting at an equal distance P P'; and, consequently, whatever weight acting at the extremity is found sufficient to break a beam when firmly fixed in a wall, it will require an equal weight hung on at each end of a similar beam of double length, when relying on a prop in the middle, to produce the fracture. And the forces W and W', which we have seen is necessary to overcome the re-actions at D and C, an equal weight, W, must be added to overcome the equal re-action in the section E F; therefore the whole weight is equal to double that which would break the beam when only loyally supported at its two ends.

2. And hence again it follows, that whatever weight will be just sufficient to break a beam when firmly fixed in a wall, a double weight will be required acting in the middle point, of a similar beam, of double length, supported on two props, as in fig. 8; for it will be exactly the same as to the mechanical action, whether we consider the weight as acting at E, and the beam turning about P and P', or whether we suppose a fulcrum at E, and the beam turning about that point by means of weights W, W', pulling over the pulleys Q, Q', and each equal to half the centre-weight W, and the latter is evidently the same as the action of the weights W, W', fig. 6, only that they are acting in an opposite direction.

3. When a beam is loaded on any other point than its centre, and having its extremities resting on props, the strain upon it will be as the rectangle of the two unequal parts, and therefore the strain will be the greatest, or the strength of the beam the least, when the weight acts at the centre.

4. Let the weight W press upon the beam at C (fig. 9.), then is the weight equal to the preusses upon A and B; and the preuss upon A = \( \frac{W \times BC}{AB} \), while the preuss upon B = \( \frac{W \times AC}{AB} \); but the re-action of either point of support is equal to the preuss upon it, and this may be considered as a force acting at the point C, as upon the arm of a lever; so that the forces at C, is as the preuss at either point of support its distance from C, that is, the preuss is as \( \frac{W \times BC}{AB} \times AC \), or as \( \frac{W \times AC}{AB} \times BC \), which are manifestly equal to the one to the other; but as W, and A, B, are given, the forces varies as the rectangle; or if we suppose the ultimate strength of fibre the same, then W will vary inversely as the rectangle; and as the rectangle is the greatest when the parts are equal, therefore in the same case the strength of the beam will be the least.

The same thing will obtain, if the weight be equally diffused through the whole of the beam; for in this case, as in the former, the sum of the preusses upon A and B will be equal to the whole weight; and if \( \omega \) be the weight of the part BC, its preussure upon A will be \( \frac{\omega \times \frac{1}{2} BC}{AB} \), and this referred back to the point C, will give \( \frac{\omega \times \frac{1}{2} BC}{AB} \times AC \) for the stresss, which therefore varies as the rectangle BC \( \times AC \), as before.

4. When a beam is firmly fixed at both ends, as in two walls, or otherwise, the weight necessary to break it will be double of that which would produce the fracture if the ends were only supported.

Let ABCD (fig. 10.) represent a beam firmly fixed at each end, which is to be broke with a weight hanging upon itscentre-point, as at E. Now, first let us suppose the beam cut through at E, so as to offer no resistance, and suppose the weight to be hung on so as to act equally upon the arms DE, CE, then W must be equal to double that which would break one part, as is obvious; and this is the same as would break the whole beam, when only supported at its ends by one prop, consequently when the beam is whole in the section E, before the weight W, which we have seen is necessary to overcome the re-actions at D and C, an equal weight, W, must be added to overcome the equal resistance in the section E F; therefore the whole weight is equal to double that which would break the beam when only loyally supported at its two ends.

5. When a beam is fixed with one end in a wall, at any given oblique angle, the weight necessary to produce the rupture, is to the weight which would break the beam, if fixed horizontally, as radius to the cofine of the angle.

Let ABCD (fig. 11.) represent a beam fixed in a wall at the angle shown in the figure; let D E be the vertical direction of the weight, and let this weight be represented by the line D E, and resolve this into the two forces D B and B I, the former perpendicular, and the other parallel to the beam A B; then it is obvious, that D B only will denote that part of the weight which is effective in producing the fracture, and that a weight which is to W, as D B is to D I, would break the beam when placed horizontally; therefore conversely, the weight necessary to break the beam in this position is to that which would break it when fixed horizontally, as D I to D B; or as radius to the cofine of the angle of inclination of the beam to the horizon.

Most authors, indeed all we have ever read, make the strength in this case as the square of the radius to the square of the cofine; because the area of fracture is greater in the proportion of radius to cofine, which blended with the mechanical effect of the lever, gives rad.** coff.; but the result of experiment by no means justifies such an hypothesis, nor does a physical consideration of the subject render it necessary, the number of fibres being the same in both cases.

We may now bring under one point of view the deductions drawn from the preceding propositions; viz.

1. The strength of a beam fixed with one end in a wall, and loaded at the other end, is to the strength of a beam of the same length, supported on two props, and loaded in the middle, as 1 to 4, or to a beam of double the length, loaded in the middle, as 1 to 2.

2. The stresss upon a beam, arising from the same weight placed at different points, is as the rectangle of the two parts; and, therefore, the strength of the beam, or its resistance to fracture, will be inversely as the same rectangle; and, con-
STRENGTH OF MATERIALS.

consequently, the forces is the greatest, or the strength the least, when the load is placed in the centre.

3. The resistence to fracture in a beam supported only at its extremes, is to the resistence of the same when fastened at both ends, as 1 to 2.

4. The forces upon a beam, arising from any oblique action upon the portion of the circumference, or on the resistence will be in this case as radius to the cofine of the angle.

These results are all independent of any particular theory of resistence, or rather, they form a part of every one; but they require certain modifications when applied to the determination of the absolute strength of beams. While they are merely used for ascertaining the proportional strengths, for the purposes of building, machinery, &c., they may be properly employed in the forms above given; it will be proper, however, to point out a few of the modifications to which we have alluded, as it will tend to clear up some apparent anomalies which have arisen in the experiments of M. Buffon, Belidor, Parent, Petit, &c.

In the first place, then, it will have been observed, that all our deductions have been made upon the supposition, that the beam prefers its rectilinear form and original position, and no account whatever has been taken of the deflection which it experiences from the horizontal or oblique line in which it is first supposed to be placed; nor is it necessary to attend to this circumstance whilst our views are carried no farther than determining the proper dimensions of timbers, in buildings, mechanical contrivances, &c., because these are never submitted to strains that cause any important deflections; but when we attempt to reconcile theory with the result of experiments in which the beams are absolutely fractured, we must no longer omit the introduction of these particulars into our investigations.

Indeed, therefore, of supposing a beam fixed at one end in a wall, and loaded at the other, to retain its horizontal position, as in fig. 6, we must consider it as being very considerably deflected out of that position, as in fig. 12; and if we here, for the sake of perspicuity, represent the resisting force of the fibres to fracture by a weight W, it will be obvious that, in order that P and W may be in equilibrio, the weight W must be to the weight P, not simply in the inverse ratio of the arms A I, A C, but as these differences into the lines of their respective angles of direction; that is, as A I ×

\[ \text{sin. A I} : \text{A C} \times \text{sin. A C} : : \frac{A C}{A I} \times \frac{A I}{A C} = \frac{A C}{A I} ; \]

whereas our former result was \( \frac{A C}{A I} \); the weight therefore required to break a beam in this position, is greater than what we found it to be in the case where no deflection was considered, in the ratio of the cofine of the angle's deflection radius.

This is sometimes a very important quantity; as we have seen beams of three feet length, and two inches square, deflected twelve or fifteen inches, that is to say, to the amount of one-third of their length, or 20°: and the cofine of 20° is to radius as 93 to 100.

The reverse of this happens when a beam is loaded in the middle, and supported at its extremities on two props; for in this case the re-action of the props is not made, as we have supposed, in a direction opposite to the vertical action of the weight, but perpendicular to the arms of the lever.

The beam ABCD (fig. 13.) is therefore kept in equilibrio with respect to its strain, by the action of three forces, viz. the weight W, the quantity and direction of which may be denoted by the diagonal S G, viz. the diagonal of the parallelogram, of which P S, P S, are two adjacent sides, and which equally denote the quantity and direction of the reaction of the props; which will therefore be greater than \( \frac{1}{4} W \); the quantity we have suppos'd in our former investigation, in the ratio of S F' to S F; that is, in the ratio of radius to the cofine of the angle of deflection.

Hence it appears that when a beam is fixed at one end, and the computed weight necessary to break it is \( W \), the real weight that must be employed will be \( W \frac{\text{cof. } D}{\text{cof. } D'} \); D denoting the angle of deflection; but when the beam is supported at both ends, and the computed weight \( W' \), and the angle of deflection \( D' \), then the real weight will be \( W' \frac{\text{cof. } D}{\text{cof. } D'} \).

Hence, supposing the former beam to have the same breadth and depth, but only half the length of the latter; we shall have, according to the preceding theory, \( W' : W : : 1 : 2 \); whereas, from this modification of it, the analogy is \( W' : W : : 1 : 1 \) cof. D. cof. D', which (if the beams are small in proportion to their length, as was the case with those of M. Parent) is quite sufficient for reducing the ratio to 3 or 4:6, as found by that author.

Again, with regard to a beam having its two ends solidly fixed, its strength, according to our preceding investigation, as compared with an equal beam supported at both ends, is as 2:1; but this supposes the three fractures to take place at the same time, or that the same deflection that is necessary for producing the fracture at F (fig. 10.) will also at the same time cause the fracture to happen in the two sections DA, CB; but this, like the preceding, will not apply to the ultimate result; as the deflection of the half beams A F, B F, is found in experiment to be nearly double that of the whole beam A B; and therefore, supposing the deflection to be as the weight, as it is in fact very nearly for a considerable time, it will only require, in addition to the weight that would break the beam, when supported at its ends, such a weight as would produce the deflection in the half beams, equal to that at which the supported beam breaks; that is, about half the dead weight; and, consequently, the ratio of the strength of the fixed beam to that which is merely supported, instead of being as 2 to 1, will be reduced to that of 5 to 2, or 4:6, as found in the experiments above referred to, as well as in those of Belidor, as published by him in his "Science des Ingenieurs." M. Parent found that a beam supported at one end only in a wall, and another of double length supported at both ends, and an equal beam fixed at both ends, broke with weights which had very nearly the proportion of 4:6, and 9:1: whereas the theory, which takes no account of deflection, gives 4:8, 16; but what is stated above, shews that Parent's numbers are those which ought to be found by experiment; and the same explanation renders the results in the following table of Belidor also perfectly reconcileable with each other.

We have also, since the above was written, made several experiments of the same kind, in order to compare the strength of beams according to the manner in which they were supported or fixed, at one end or both; and according as they were fixed horizontally, or at different angles of inclination; and in all those cases the results answer very nearly to what the preceding theory requires. Thus a beam of fir fix feet long and two inches square, supported at each end, broke with 744 lbs.; and the mean of several experiments on similar pieces of the same dimension fixed at each end, require 1105 lbs.; and the fragments of the same, three feet long, broke with one end in a wall, required at a medium 400 lbs.; the ratio of which numbers are not very different from those above stated.

Y y

Belidor.
By a comparison of these results, we find
1. From a comparison of experiments 1 and 3, that the strength is proportional to the breadth.
2. Experiments 3 and 4 shew that the strength is proportional to the square of the depth.
3. Experiments 1 and 5 shew the strength to be nearly in the inverse ratio of the length.
4. Experiments 5 and 7 shew the strength proportional to the breadth and square of the depth.
5. Experiments 1 and 7 shew, by combination, that the strength is in the ratio of the area of fracture into the depth, and in the inverse ratio of the lengths.
6. Experiments 1, and 2, as also 5 and 6, shew that the strength of beams fixed at both ends is in a ratio of those which are only supported in the ratio of 3:2.

We have shewn that this last proportion is about what ought to result from experiments; although no theory that we know of introduces this consideration.

Another discrepancy between theory and experiment is, where the strength ought to be inversely as the length, it is, in fact, in the above experiments, but is very remarkable in those of M. Buffon; and though our preceding remarks will explain very satisfactorily this deviation, we are almost afraid to offer it as an illustration; after seeing it treated as an inexplicable paradox by some writers of the first eminence: Dr. Robison, for example, says, "the engineer will carefully keep in mind the important fact, that a beam of quadruple length, instead of having one-fourth of the strength, has only about one-fourth; and the philosopher should endeavour to discover the cause of this diminution, that he may give the artizan a more accurate rule of computation."

In another place he attempts to account for it from physical considerations, viz. that the trees being strongest at the root end; Buffon's longest pieces were broke in the weakest part, which however does not appear quite certain, as we cannot tell from which end his shortest pieces were cut; he also thinks, that the curvature being greatest in the longer pieces, may also be a cause of the deficiency above alluded to. We are not disposed to deny that these may both have an influence; but it certainly appears to us, that instead of looking for a physical explanation, what we have before remarked with regard to the deflection is quite sufficient to account for the anomaly on pure mathematical principles. We have seen, that if W be the computed weight, independent of deflection, the absolute weight will be W cof. D, D being the angle of deflection; and as this deflection, both from theory and practice, is found to increase as the square of the length; it follows, that when the length is quadrupled, the depth of deflection will be sixteen times greater; that is, the sine of the angle of deflection will be sixteen times more in one case than in the other, while the radius will be only four times longer; and therefore, the angle is in one case about four times what it is in the other, (supposing in a rough way the angle to vary as the sine). Consequentially, if W x cof. D is the weight which breaks the shorter beam, 4W x cof. 4D ought to be that which breaks the longer one; and this we presume will nearly, if not entirely, account for the decrease of strength in Buffon's experiments. We cannot perceive but that this reasoning is perfectly legitimate, yet we are astonished that it should not have occurred to so keen a mathematician as the one to whom we have alluded, or to some of the writers on this subject, and on this account we offer it with some hesitation.

The following table contains the result of Buffon's experiments, which are by far the most valuable of any that have yet been made, both on account of the number of them, and the size of the beams that were employed. The dimensions are given in metres, and the weights in kilograms, as reduced by M. Girard, except that we have not always retained the same number of decimals; these may be reduced to English measure by observing, that 1 metre = 3.281 English feet, and 1 kilogram = 2.20462 lb.

<table>
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<th>№</th>
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<td>1</td>
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STRENGTH OF MATERIALS.

Table of Buffon's Experiments on the Strength of Square Oak-beams, supported at both Ends.

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<th>No. of Ex.</th>
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<th>Length of the Piece</th>
<th>Weight of the Piece</th>
<th>Weight which it bore before it broke</th>
<th>Deflection before the Fracture</th>
<th>Time from the first Fracture to the final Rupture</th>
<th>Deflection at the instant of Rupture</th>
<th>Lengthening or stretching of the Fibres to a Metre in Length</th>
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## STRENGTH OF MATERIALS.

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STRENGTH OF MATERIALS.

It remains now for us to offer a few observations with regard to the relation between the strength of direct cohesion, and the strength of beams submitted to transverse strains; but, unfortunately, we have very little on which to rest any theory in this respect. We know of no experiments that have yet been made with a view to this determination, except those to which we have referred, as being at present in progress at the Royal Military Academy, and these are not yet sufficiently forward to enable us to offer any decided theory.

According to Galileo's theory, if \( f \) denote the strength of direct cohesion, that is, the number of pounds necessary to break a bar of one inch square; \( a \) the area, in inches, of the section of fracture; \( d \) the depth of its centre of gravity from the edge about which the beam is supposed to turn; and \( l \) the length, also in inches; and \( W \) the required weight, then

1. When the beam is fixed at one end in a wall,
   \[
   W = \frac{fa}{l}.
   \]

2. When the beam is supported at both ends, then
   \[
   W = \frac{4fa}{l}.
   \]

3. When the beam is fixed at both ends,
   \[
   W = \frac{8fa}{l}.
   \]

The weight in both the latter cases being suppos'd to rest on the middle of the beam, and in the first at its end. When the weight acts at any other part of the beam, the stress varies directly as the rectangle of the two parts, or the strength is inversely as the distance.

According to Leibnitz's theory, if \( a \) is the area, \( l \) the length in inches, and \( f \) the strength of direct cohesion in pounds, on a square inch, as before; also \( D \) the depth of the section of fracture, \( \Delta \) the distance of its centre of oscillation, and \( d \) that of its centre of gravity from the point about which the beam turns, then

1. When the beam is fixed at one end,
   \[
   W = \frac{fa \Delta d}{D}.
   \]

2. When the beam is supported at both ends,
   \[
   W = \frac{4fa \Delta d}{D}.
   \]

3. When the beam is fixed at both ends,
   \[
   W = \frac{8fa \Delta d}{D}.
   \]

From these general theorems it is usual to draw a variety of corollaries as to the strength of beams of different forms, and in different positions. Thus, from the former, it appears that a triangular beam, fixed with one end in a wall, with its edge downwards, or supported at its two ends, with its base downwards, has double the strength of an equal beam laid the contrary way, i.e., with its base down in the first case, and upwards in the second; and Leibnitz's formula makes the strength three times as much; whereas experiment proves that the beam is weaker in both these cases, where, according to their theory, it should be so much stronger.

Similar erroneous conclusions are also drawn from these theorems, with regard to hollow cylinders, not bored through the axis, but on one side of it, the strength, according to the above, being greatest when the beam is made to turn about the thinnest part: but here, again, experiment shews it to be weakest in that position.

With regard to the hollow cylinder bored through its axis, the above theorems, though they are still inaccurate with regard to the proportion between the direct cohesion and the transverse strain, are not much out in respect to the proportional strength, according to the size of the bore, and the thickness of the sides: in fact, both sets of theorems give the same results, with regard to the proportional strengths, as depending upon the lengths, depths, breadths, &c. of the beams, while the same remain of the same form, and rest in the same position; it is in the comparison of different formed beams with each other, or different positions of the same beam, where the defects is the most obvious, and particularly with regard to all beams, as depending upon the strength of direct cohesion. On this account, we shall dispense with the corollaries and deductions above referred to, as being more likely to mislead than to instruct the engineer, although we thought it right to mention them; and if we cannot supply them with well established rules and formulae, we will at least endeavour to point out how such may be obtained.

We have already stated that the beam, instead of turning about the line \( CD \) (fig. 1), as suppos'd by Galileo and Leibnitz, really turns about a line within the area of fracture, as shewn by the section, fig. 5; viz. instead of turning about the lower point \( C \), the beam will turn about some other line, represented in the figure by \( n \), the situation of which is unknown, but whose position is absolutely necessary to be determined, in order to establish a correct theory of the strength of beams. According to Du Hamel's experiments on willow, it is at about one-third the depth from \( A \), and therefore, that we have made, make it about the same for fir: and though there may be some difference in this respect, in woods of different kinds, it is probably not far from that point in any.

Now all the fibres between \( n \) and \( A \) are those only which are in a state of tension; the others between \( n \) and \( C \) being in a state of compression; while the fibres in the line, of which the section is \( n \), will be neither compressed nor stretched; on which account this is commonly called the inner line, or neutral axis. Hence we see, that in the theories of Galileo and Leibnitz, the strength of beams, as deduced from the strength of direct cohesion, must far exceed the real strength, not more than one-third of the fibres, which they suppose, being employed to refit the fracture at least by tension; also the centre of tension being at one-third of the distance they have assumed, these combined would make the real strength only one-ninth of the computed strength. But as we may suppose that exactly one-half of the entire force is employed in producing the compression, that is, that the beam turns about that point where the resistance to compression is equal to that of tension, this reduces it to \( \frac{4}{3} \) times; that is, the computed strength is about \( \frac{4}{3} \) times greater than it would be, if the neutral line were, as we have suppos'd, at one-third of the depth from the upper surface of the beam.

This defect is common to both these authors, after conceding to each his own particular law of tension; that is to say, to Galileo, that every fibre acts with the same energy; and to Leibnitz, that the tension is as the forces. But both of these suppositions must be erroneous; and we must say, that, independent of experiments, we should certainly have been inclined to adopt the latter; but we are convinced, from a great multiplicity of results, that Galileo is much nearer, if not exactly conformable to the actual operations...
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operation. However difficult it, therefore, may be to account for this equality in the force of tension on physical principles, we must adopt it as a fact deduced from experiment, and leave to the philosopher the explanation of its existence.

Our limits will not admit of reporting here the nature of the experiments, nor the calculations founded upon them, which led to this determination; but we hope soon to see them laid before the public in another form. We can only give here the result, which, as far as it is at present ascertained, is as follows:

The centre of tension and centre of compression are nearly or exactly coincident with the centre of gravity; and the neutral line, whatever may be the figure of the section, is so positioned, that the rectangle of the area of tension into the distance of its centre of gravity from the said line, is to the rectangle of the area of compression into the distance of its centre of gravity as $I$ to $3$.

From which theorem, the neutral line for any formed beam may be determined, and the absolute strength may then be found as follows, viz.: Let $d$ denote the distance of the centre of tension from the neutral line, $a$ the area of tension, and $I$ the length of the beam, all in inches; $D$ the angle of deflection, and $f$ the strength of direct cohesion on a square inch; then, without considering the increased length of lever,

1. When the beam is fixed at one end,

$$ W = \frac{3fa}{l} \times \text{cof. } D. $$

2. When the beam is supported at both ends,

$$ W = \frac{8fa}{l} \times \text{cof. } D. $$

3. When the beam is fixed at both ends,

$$ W = \frac{12fa}{l} \times \text{cof. } D. $$

And when the beam is fixed at one end at any angle, formula (1) will still apply; only increasing or decreasing the angle of deflection by the quantity of the first angle of inclination, according as that inclination is downwards or upwards.

And when the beam is supported, or fixed, at both ends, and either refting obliquely, or acted upon by an oblique force; the two latter formula become:

4. For the beam supported at each end,

$$ W = \frac{8fa}{l} \times \text{cof. } D. $$

5. For the beam fixed at each end,

$$ W = \frac{12fa}{l} \times \text{cof. } D. $$

Where I denotes the angle which the direction of the force makes with the direction of the beam.

Note 1. It should be observed that the preceding theorem, for determining the neutral line, is principally drawn from experiments on fir-beams. A different ratio than $1:3$ may be necessary in other kinds of wood; but at present that ratio has not been found.

Note 2. The deflection $D$, as we have before observed, is not a necessary datum in estimating the strength of timber, for any practical purposes of building, &c.; it is merely introduced in order to reconcile theory with the result of experiments made upon the absolute and ultimate strength in which case, particularly in long beams, it becomes an important quantity, and must not be omitted; and in all cases where it is required, it must be drawn from some prior experiment on the same kind of wood, by means of the following theorem, viz.: Let $I, d$, and $D$, represent the length, depth, and deflection of any beam; and $I'$ and $d'$ the length and depth of any other beam, whose deflection $D'$ is required; then,

$$ D' = \frac{I'}{I} \cdot \frac{d'}{d} \cdot D. $$

See the several works referred to in the beginning of the article, by Bernoulli, Euler, Lagrange, &c.

We shall now illustrate these theorems by a few examples.

Example 1.—The strength of direct cohesion on a square inch of fir being 15,000 lbs., required the weight necessary to break a rectangular bar 30 inches long, 2 inches deep, and 1 inch in breadth; when fixed at one end in a wall, and the weight acting at the other; the deflection, computed from other experiments, having been found to be 5 inches.

First, to find the neutral line: here, since the section is a rectangle, the centres of tension and compression are each on the centres of their respective areas; therefore, call the depth of tension $x$, the depth of compression will be $2-x$; which also denote these areas; and we must have, therefore,

$$ x^2 + \frac{(2-x)^2}{2} = 1 + \frac{3}{2}; $$

or $3x^2 = 4 - 4x + x^2$; or $x^2 + 2x = 2$.

Whence $x = -1 + \sqrt{3} = .732 = a$;

and $\frac{.732}{2} = .366 = d$;

$$ \tan. \text{ of deflection} = \frac{5}{30} = \frac{1}{6} = .1666666. $$

Whence the angle $D = 5^\circ 34'$, and its cosine = .9860; therefore, by formula 1,

$$ W = \frac{2fa}{l} \times \text{cof. } D = \frac{2 \times 13000 \times .732 \times .366}{30 \times .986} = 235 \text{ lbs.} $$

Example 2.—Required the weight that would break the same beam when supported at each end, rejecting the deflection, which is very inconsiderable.

By formula 2,

$$ W = \frac{8fa}{l} = \frac{8 \times 13000 \times .732 \times .366}{30} = 928 \text{ lbs.} $$

Example 3.—Required the weight that would break the same beam fixed at each end. Rejecting the deflection, we have from formula 3,

$$ W = \frac{12fa}{l} = \frac{12 \times 13000 \times .732 \times .366}{30} = 1492 \text{ lbs.} $$

Note.—We have here assumed 13000 for the force of direct cohesion; this, however, rather exceeds the greatest strength of fir, which varies from 10000 to about 15000 lbs.

Example 4.—Assuming the direct cohesion at 13000, and the specific gravity of fir 720; how long must a beam be that is two inches deep, and one inch broad, which, fixed with one end in a wall, will just break with its own weight?

Let $a$ be the required length of the beam, in inches; its weight
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weight will be \( \frac{2x \times 720}{1728} \) ounces, or \( \frac{90x}{1728} = \frac{5x}{96} \) pounds;

and this weight will have the same effect as if it acted all at
one point in the centre of the beam, or at the distance \( \frac{1}{2} x \).

Hence, by substituting \( \frac{5x}{96} \) for \( W \) in formula 1, we have

\[
x^2 = \frac{2 \times 15000 \times 732 \times 366}{96} \times \frac{1}{x}
\]

or \( 5x^3 = 192 \times 2 \times 13000 \times 752 \times 366 = 133728 \).

Whence \( x = \sqrt{\frac{133728}{5}} \) inches, or 47 feet. In this

case, the angle of deflection is not introduced.

When the deflection is considered, as it should be in this
case, we find it to be from the data of example 1, and the
theorem for the deflection, as

\[
\frac{30}{5} = \frac{1}{x} \cdot \frac{5x^3}{3600}
\]

Whence the cosine

\[
\cos \theta = \sqrt{\left(1 - \frac{25x^3}{1800}\right)}
\]

and the above

equation becomes

\[
x^2 = 2 \times 15000 \times 732 \times 366 \times \sqrt{\left(1 - \frac{25x^3}{1800}\right)}
\]

which produces a cubic equation, whence the value of \( x \) may
be determined.

It remains now to add a few particulars relative to the
transverse strength of stones and metals, but our information
on this head is limited; very few experiments having yet
been attempted, except those of Mr. Banks on bars of caft-
iron, and a few made by Dr. Robison on small pieces of
marble.

Mr. Banks has, at various times, made many experiments
on the real and comparative strength of oak, fir, and iron.
He found that the worst on weakest piece of dry heart
oak, 1 inch square and 1 foot long, bore 660 lbs., though
it was much bent, and 2 lbs. more broke it. The strongest
piece he tried of the same dimensions broke with 974 lbs.;
the worst piece of deal bore 460 lbs.; but broke with
a little more.

With respect to caft-iron, he concludes that a bar of
the weakest kind, an inch square and a foot long, would break
with 2100 lbs.

The following are some of the experiments he mentions.

See Banks on Power of Machines.

Experiment 1.—Two bars of caft-iron, 1 inch square and
3 feet long, were placed upon a horizontal bar, so as to
meet in a cap at the top, from which was suspended a scale;
these bars made each an angle of 45° with the base-plate;
and, of consequence, formed an angle of 90° at the top:
from this cap was suspended a weight of 7 tons, which was
left for 16 hours, when the bars were a little bent, but very
little.

Experiment 2.—Two bars, of the same length and thick-
nesses, were placed in a similar manner, making an angle of 24°
with the base-plate: these bore four tons upon the scale: a
little more weight broke one of them, which was observed
to be a little crooked when first put up. In this case, the
pressures would be as the sines of the angles of elevation,

\[
\sin 24° : \sin 45° = 2 \times 720 : 96
\]

1. Rib 29 feet 3 inches span, a segment of a circle
3 feet high in the centre; it supported 99 cwt. 1 qr. 14 lbs.;
it funk in the middle 34 inches, and role again three-fourths
when the weights were removed: the same rib was after-
wards tried without abutments, and broke with 55 cwt.
9 qr. 14 lbs.

2. Rib 29 feet 3 inches span, a segment of a circle
3 feet high in the centre; it supported 100 cwt. 1 qr. 14 lbs.,
and funk 1 x in the middle. The same rib was afterwards
tried without abutments, and broke with 64 cwt. 1 qr. 14 lbs.
The thickest of these ribs is not specified; but the ex-
periments prove that each rib exerted little more than half
the strength when the abutments were removed.

Mr. Banks made some experiments on the strength of caft-
iron, at Meffrs. Aydon and Elwell’s foundery, Wakefield.
The iron came from their furnace at Shelf, near Bradford,
and was cast from the air-furnace; the bars 1 inch square,
and the props exactly 3 feet distant; one yard in length
weighed exactly 9 lbs., or one was about half an ounce less,
the other a little more; they all bent about an inch be-
fore they broke.

1. The first bar broke with
2. The second bar with
3. The third bar with
4. A bar made from the copper
5. A bar equally thick in the middle, but the
ends formed into a parabolic form,

\[
965 \text{ lbs.}
\]
\[
968
\]
\[
964
\]
\[
884
\]

The fame gentleman made many other experiments, and
concludes, from the whole, that cast-iron is from 3\( \frac{1}{2} \) to 4\( \frac{1}{2} \)
times stronger than oak of the same dimensions; and from
5 to 6\( \frac{1}{2} \) times stronger than deal.

We shall only observe here, that Mr. Banks’s pieces of
oak exceed very considerably the specimens that we have
had an opportunity of trying, while his fire falls somewhat
short of ours.

It was our intention, in conclusion, to have added a few
examples illustrative of the several rules and principles laid
down in the preceding pages; and also investigations re-
relative to the form of beams possessing equal strength through-
out, or beams of equal resistance; but as this article has
already exceeded the usual limits, we can merely state the
results, and must leave the investigation to the reader; or
we may refer him to Gregory’s Treatise of Mechanics,
where all these subjects are investigated at length.

As the bream upon any beam submitted to a transverse
strain is directly as the length, and the strength directly as
the breadth into the square of the depth; it follows, if the
sections are so proportioned to the lengths, that the breadth

into the square of the depth is always as the length or distance from the point where the weight acts; that every part of the beam will be equally strong, in which case it is laid to be a beam of equal refinance: hence, when a beam is fixed with one end in a wall,

1. If the breadth is the same throughout, the lengths must be as the square of the depths; and consequently the vertical sides of the beam will be parabolae.

2. If the depth is the same throughout, the breadths must be as the lengths, and the upper and lower sides of the beam will be triangles.

3. If the several sections be circles, the cubes of their diameters (which is equivalent to the breadth into the square of the depth) must be as the lengths; and the curve will be the cubic parabola.

4. The strongest beam that can be cut out of any cylindrical beam or tree, is that in which the breadth into the square of the depth is a maximum; which will be the case when the squares of breadth and depth, and the square of the cylinder's diameter, are to each other as the numbers 1, 2, and 3.

As to our fourth head, relative to the wrenching or twisting of a body, very little that is satisfactory can be advanced; according to Mr. Banks, a cat's-iron bar an inch square, and fixed at one end, will break by the twist when 631 pounds are furnished by a wheel of two feet diameter, and made to act upon it; though some have required more than 1000 lbs. in similar situations, to break them by the twist. The strength to resist the twisting strain is as the cube of like lateral dimensions.

STRENGTHENERS, Corrombantes: such medicines as add to the bulk and firmness of the solids. Strengtheners differ from cordials, as a bandage does from a flint-brush; the latter are such as facilitate and drive on the vital actions; but the former, such as confirm the flatus, and maintain the solids in such a condition, as to exert themselves into action on all proper occasions, with the greatest force and vigour.

The continual wails which constant motion makes in the constitution, were not for frequent and proper supplies, would soon wear the body quite out. The attritions and abrasions of the circulating fluids would quickly carry away the canals in which they circulate, were not somewhat furnished in their composition, which is fitted to fall into, adhere with, and recruit, that which is washed off. And those particles must be much more disposed to do so, whose adhesions are greatest, when once they come into contact; such are those of bodies we call platinous, and which easily form themselves into jellies, and flax-like consistencies; for the parts of such bodies are very light, by the over-proportion of their surfaces to their solidities, by which their motions are both more languid when in circulation; and, when they stop, their cohesions will be much the stronger, with whatsoever they happen to fall into contact. See Nutrition.

Medicines of this tribe are therefore of great service in hysteric, where the swift motion of a thin, sharp blood, wears away the substance of the body, instead of nourishing it; for they not only retard the inordinate motion, but give such a weight and confidence to the juices, as fits them also for nourishment. There are likewise other caustics which may weaken the solids, by admitting or occasioning them to relax too much.

Whatsoever, therefore, acts as a stimulus, and cribs and corrugates the fibres into a more compacted tone, which most sufferers and pointed bodies do, will remove such weaknesses, and increase strength; and as too much moisture may also contribute to such a relaxation, what has no other quality but that of absorbing, and drying up such superfluous humidities, may deserve, though accidentally, to come under this denomination.

An artificial method of procuring a powerful, safe, and innocent strengtheners is the following. Put half a pound of fine Peruvian bark, reduced to a subtile powder, into a long or tall glass body, and pour upon it two quarts of spirit of wine; shake them well together, and let them in a lumber two or three days, or till the spirit of wine is of a fine purple colour; pour off this tincture, and press the pieces very strongly, to get it all away; then return the powder into the same vessel, and pour upon it two quarts of strong white wine; let this in lard for two or three days, then pour off this tincture; mix it with the former, and putting the whole into a glass body, distil off a great part of the spirit of wine; then put the remainder into a glass earthen pan, and evaporate it to the form of an extract, adding, toward the end, three ounces of syrup of orange-peel.

This is the invention of Charaz, and seems the best preparation of bark known. Beside all the common celves in which the bark is given, this preparation may be tried in other weakening distempers as well as intermittents fevers, as the inconveniences attending the taking of the bark in substance are obviated by this preparation, which is equally powerful and innocent. It may be aromatized at pleasure with any of the essential oils. Shaw's Lectures, p. 232.

STRENGTHENING PILLS. See Pills. Strengthening Bands of Sea-Shores, in Rural Economy, the securing of them against the force, power, and effects of floods and high tides. This fort of protection is much wanted in many situations and sea-coast districts in different parts of the kingdom, and is capable of being performed in various ways in different circumstances and cafes. See Sew-Wall, and Embankment.

STREINITZ, in Geography, a town of Bohemia, is in the circle of Bolefor; 3 miles W. of Jung Buntzelt.—Alto, a town of Bohemia, in the circle of Chrudim; 6 miles N.E. of Politza.

STRENUA, in Mythology, a goddess among the Romans, of an opposite character to the goddess of "Sloth," who, according to St. Augustine, made men to over-acet, and who had a temple at Rome. The goddess of sloth was named Marcia, and Streuna and Ageronia inspired their votaries with vigilance and courage. The chapel of Streua was situated, as Varro informs us, near the Via Flacc.

STREPTOSUS, the name of a diapper common to the inhabitants of some parts of the Alps, in which the face, neck, and arms, are fo deflected with flatulencies, as to make a noize, when struck, like a dry bladder half deflected with wind.

STREPSICEROS, in Zoology. See Ovis.


1. S. filopes.—Gathered by sir Joseph Banks, in the tropical part of New Holland. A grass with the aspect of an Arrhida or Stipa, differing from the latter genus in the want of an articulation between the awn and its glume. Brown.

1. S. amplifolius. Heart-shaped Streptopus. Redouté Liliac. t. 359. (S. ditortus; Michaux n. 1. Pursh n. 1. Uvularia amplifolia; Lim. Sp. Pl. 436. Wild. Sp. Pl. v. 2, 93. Ait. Hort. Kew. v. 2, 246. Wald. et Kitaib. Hung. v. 2, 182, t. 167. Polygonatum ranwum; Ger. Em. 904. Laurus alexandrae; Mattth. Valgr. 516, bld.)—Smooth. Leaves heart-shaped, clasping the stem, entire and incised-edged. Anthers with a fimbriate point.—Native of Bohemia, Hungary, Dauphiny, Switzerland, &c. as well as in sandy mountainous woods from Canada to Pennsylvania, flowering in May and June. The root is fibrous and perennial. Stem erect, twelve or eighteen inches high, herbaceous, branched, leafy. Leaves alternate, sessile, pointed, many-ribbed, two or three inches long, clasping the stem with their rounded heart-shaped base; paler and rather glaucous beneath. Flowers pendulous, greenish-yellow, the size of our Lily of the valley, each on a solitary, axillary, unbranched, slender, smooth stalk, not half so long as the leaf, with a complete convolution in the middle, not expressed in Matthioli’s cut. Berry orange-coloured, the size of a pea, with a thin rind. We cannot but prefer the pretension of the original specific name, after the correct example of M. Redouté, instead of Michaux’s new one which is not peculiarly applicable to the present species.

2. S. rufus. Rosy-coloured Streptopus. Michaux n. 2. (Tortula rufa; Wild. Sp. Pl. v. 1, 146. Ait. Hort. Kew. v. 1, 146.)—Native of the East Indies. Found by Dr. Roxburgh, only in the vicinity of Samulcotth, on the terraces of old walls of pagodas, flowering during the wet and cold feasts. This plant is not put to any use. While young it is not inedient, though resembling *Verbena laevis* Linn. The root is perennial. Stem rather shrubby, perennial, with rough, flaky, leafy, opposite branches, from two to four feet high. Leaves opposite, flarked, heart-shaped, serrated, one or a half or two inches long, clothed with brownish bristles. Flowers white, in very long, simple, terminal, minutely bracteate, *pales*, the leaf from the fork of the branches. Fruit the size of a pea, drooping, clothed with the rough brown calyx.

There being a very well-established genus of mosses long ago named *Tortula*, see that article, we cannot account for Willdenow’s name for the present genus being preferred in Hort. Kew. to that already published by Mr. Dryander himself.

STREPTOPUS, from *reptio*, twisted, and *sua*, a foot; because of a peculiar twist about the middle of each flower-stalk.—Michaux Boreali-Amer. v. 1, 200. Pursh 232.—Clas and order, Hexamnia Monogynia. Nat. Ord. Sarmentaeae. Linn. Aparagi, Juss.

Gen. Ch. Cal. none. Cor. inferior, somewhat bell-shaped, smooth, of five lanceolate acute petals, reflexed at the point. Nectary a furrow along the middle of each petal. Stam. Filaments five, awl-shaped, much shorter than the corolla, inserted into the base of each petal; anthers oblong, pointed, erect. Pfl. Germen superior, globular; style longer than the filaments, slightly triangular, erect; stigma three, very short, obtuse. Peric. Berry nearly globular, smooth, with a thin skin, of three cells. Seeds several, though but few are perfect, nearly ovate, with a naked scar.


Obf. This genus is more allied to *Coronilla* than to *Uvularia*; it is distinguished from the former by its polypetalous corolla, with nectiferous funnels; from the latter by having a berry, not a capsule, and the want of an appendage, or tunic, to the scar of each seed.

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3. S. lanuginosus. Downy Streptopus. Michaux n. 3. Pursh n. 3.—“Somewhat hoary and woolly. Leaves sessile, pointed, slightly heart-shaped. Flower-flasks in pairs, on a very short common stalk.”—On high mountains, from Pennsylvania to Carolina, flowering in June. The leaves are abrupt, with longer points than the two former. Flowers thrice the size of the others, yellowish-green, resembling an *Uvularia*. Berries red, scarcely perishing more than one or two seeds.

Neither of these two latter species have, as yet, found their way into the gardens of Europe.

STRESI, Gros, in Geography, a town of the island of Rügen; 9 miles S.E. of Bergen.

STRETCH. When at sea they are going to hoist the yard or hale the sheet, they say, *Stretch forward the sheets*; meaning, that part which the men are to hale by, should be put into their hands, in order to their haling.

STRETCHER, in Sea Language, a sort of flax fixed athwart the bottom of a boat, for the rower to place his feet against, in order to communicate a greater effort to his oar.

STRETCHING, in Navigation, is generally understood to imply the progression of a ship under a great surface of sail, when close-hauled. The difference between this term and *flanking*, consists apparently in the quantity of sail, which, in the latter, may be very moderate; but in stretching generally signifies excess: as, we saw the enemy at day-break stretching to the southward, under a crowd of sail, &c. Falconer.

STRETENSE, in Geography, a town of Ruffia, in the government of Iurusk; 52 miles E.N.E. of Nertchink. N. lat. 51° 23'. E. long. 118° 14'.

STRETHAM. See Streatham.
STRETTENBEN, a town of the duchy of Carinthia; 6 miles E.S.E. of Preuburg.

STRETTO, Ital. in Music, to contract, shorten, as in a fugue, where, to carry on some new subject arising out of the original theme, the proporta, or short subject, may be shortened, provided enough is left to recall the hearing of the whole.

STRETTON, Church, in Geography. See Church-Stretton.

STRETWARD, in Our Old Writers, an officer whose business it was to take care of the streets, like our surveyor of the highways, or rather scavenger.

STREIBER, in Ichthyology, a name given by many to the fifth called by authors after pisicus. Gfuen, in particular, calls this fish gabisus aper.

STREUFFDORF, in Geography, a town of Germany, in the principality of Coburg; 4 miles S. of Hilberhausen.

STREWING of Peas, in Agriculture, the name of a method of sowing, in which the peas are made to stir the peas in by hand, and the usual measure is about three bushels to an acre. They should be sown about six weeks after Christmas, and the furrows be made about sixteen inches apart. The peas must be regulated according to the nature of the soil and the circumstances in which the land is. It is a neat mode of sowing in many cafes. See Peas.

STREWING-Plough for Peas, &c. A small light kind of plough, constructed with a light wheel to the sowing part, by means of which that operation is directed and regulated, and a double breast part, in order that the earth or mould may, at the same time, be turned to both fides in making the furrow or drill for the peas or other feed. It usually makes the furrow, drill, or opening, to the depth of about three inches, and feeds in width, at the top, being wrought hollow. It is sometimes made fo as only to form the drills, the peas being dropped or fried in by the hand. It is also occasionally contrived so as to drop the peas from a box fixed in the hind part of it, as it proceeds in drawing the furrow or drill.

STREY, in Geography, a river of Germany, which rises in the county of Henneberg, and runs into the Saal, 2 miles N. of Munnerrott, in the duchy of Wurzburg.

STRIE, in the Ancient Architecture, the lift, fillets, or rays, which separate the fringes or flutings of columns.

STRIATULA, in Natural History, a name given by Mr. Lhuyd to a species of foliaceous plants of the fern-kind, remarkable for their flattened appearance.

STRIBILIGO, a name given by some authors to any sort of cutaneous efflorescence.

STRICK, in Commerce, a corn-measure in Bohemia = 4 viertels = 16 maffels = 192 fiedels. It contains 5383 French or 616 English cubic inches. Hence 33 frieks of Prague are = 100 English bushels. See Table XXXI. under Measures.

STRICKLE, or STRIKE, an instrument for striking off the outer moisture of corn.

STRICKLE, in Agriculture, a provincial term applied to the wooden contrivance which is placed upon the extremity of the shaft of the felythe for whetting it with.

STRICKLESS, in Rural Economy, a name sometimes given to the tool by which the bushel is struck.

STRICTUS, in Anatomy, the name of a sphencter.

STRICTURES of the Oesophagus. Chronic inflammation of the membrane which lines the oesophagus, extending by degrees to the muscular coats of the part, increases the thickness of its parietes. This change may happen to such a pitch, that the diameter of the canal is rendered as small as that of a quill, and the aliment cannot be swallowed without great difficulty. In this state, deglutition may become so obstructed, that the patient is threatened with the danger of dying from defect of nourishment. Formerly, there was no other means of supporting him but the feeble resource of nutritive cyphers. The small number of absorbents, however, which proceed from the internal surface of the large intestines, and the slowness of cutaneous absorption, made nutritive cyphers and baths almost useless; but in modern times, elastic gum catheters are always capable of affording material relief, if not of accomplishing a perfect cure.

The catheters intended for this sort of cases are firm and easy of introduction when the filet is in them; and flexible and not at all incommoding when the filet is withdrawn after their introduction. In general, they ought to have the diameter of the largest bougies of the urethra, or even equal in diameter to the little finger. After being oiled, in order to make them more smooth, they should be passed through one of the nostrils, and when their end has arrived in the pharynx, opposite the Isthmus faucium, the filet must be withdrawn with one hand, while the other part of the instrument is pulled on with the other. Should it bend against the posterior parietes of the pharynx, the surgeon must pass his thumb and fore-finger into the mouth, and take hold of it. With these it is to be directed, so that it may not enter the larynx, but descend along the oesophagus.

It is obvious, that when the catheter is not provided with the filet, it can hardly overcome any powerful obstacle. It sometimes flops at the place of the obstruction, and bends upon itself. In a case of this description, Bovier overcame the resistance, by making use of a silver catheter, which he introduced through the mouth, and for which he afterwards substituted an elastic gum catheter. The latter was also passed through the nasum and brought up into the nostril by means of Belloq's probe. This ingenious modification of the common method, says Richerand, should always be followed, when unusual difficulty is experienced in making the elastic catheter pass from the nostril into the pharynx, and resistance in the situation of the obstruction is difficult to overcome.

The elastic gum catheter being placed in the nostril, creates very little inconvenience, and it is fixed with a bit of thread put round its upper end, and fastened to the patient's cap.

In this way, Richerand fed one man whose oesophagus was compressed throughout its whole extent, by enlarged lymphatic glands. They had acquired such magnitude, that no solid nor liquid food could pass. Richerand easily introduced through the left nostril an elastic catheter without the filet. An assistant supported the patient's head upon his breast. The instrument bent back against the back of the pharynx, and Richerand was then obliged to guide it with his fingers, which he passed into the patient's mouth. It defended a long way into the oesophagus, separating the parietes of the part, which were forced too much against each other by external pressure. The instrument was fixed in this position, and a quantity of rich soup
foup was daily injected through it. The introduction of the elastic tube became so easy, and the patient so habituated to it, that it was often taken out, the students, and even other patients, being able to put it in again and feed the patient. After some months the man died of emaciation, the glandular swellings being too far advanced to admit of diffusion.

Obstruction depending upon a thickening of the parietes of the cesophagus, must be discriminated from that which arises from the compression of the neighbouring glands; a cafe, in which the introduction of instruments is much more easy. The disease, however, is then more afflicting, as it is generally incurable; while, by perseverence in the use of the elastic gum catheter and bougies, the cesophagus may be dilated like the urethra, and the thickening of its coats diminished. See Richerand's Nefrographe Chirurgicale, tom. iii. p. 314. edit. 2.

Sir Everard Home considers fistulas of the cesophagus as very analogous to those of the urethra. He observes, that this passage being wider at one time, and narrower at another, in order to be fitted for conveying the different kinds of food into the stomach, it is nearly under the same circumstances, with respect to the formation of fistula, as the urethra. If a bougie of a proper size be introduced down the pharynx, it will often be flopped by the fistula just behind the thyroid or cricoid cartilage; for, from Sir E. Home's remarks, it would appear that the obstruction is generally as high up as this situation. However, there are other cases, in which the obstruction is only of a spasmodic nature, and in these a bougie may be passed quite down. It is curious, that fistula high up in the cesophagus often occasion ulceration in this tube very low down towards the stomach, just as fistula in the urethra excite ulceration in that passage towards the bladder. This is most apt to occur, when fistula of the cesophagus have been of long continuance, and may arise from the efforts in retching, which frequently comes on, and must strain the parts already deprived of their natural actions, and of the benefit of the secretions with which they are lubricated in the healthy state. When such ulceration takes places, the characters of the original disease are lost; and when the ulceration extends upwards, the fistula itself may be destroyed. A bougie introduced under such circumstances will, in general, have its point entangled in the ulcer; and when so skilfully directed as to go down into the cesophagus, it will meet with a difficulty while it is passing the commencement of the ulcerated part of the cesophagus, and another impediment where it leaves the ulcer, and enters the found portion of the cesophagus below. These two refulences may lead to the supposition, that there are two fistula, while, in fact, the only one is above the ulceration, as already described.

According to Sir Everard Home, true fistula of the cesophagus, like those of the urethra, occupy very little extent of the passage, consisting of a transverse fold of the passage, and being attended with very little thickening of the adjacent parts. These latter circumstances are such as render the disease capable of receiving benefit either from simple or armed bougies.

Sir Everard Home has found, that a bougie can be more easily introduced into the cesophagus, when the tongue is brought forwards out of the mouth. He remarks, that when a bougie is passed with a view of learning the nature of the cafe, and it passes down to the distance of eight inches, measuring from the cutting edge of the front teeth in the upper jaw, its extremity has gone beyond the usual seat of fistula.

The method of treatment practiced by this gentleman, consists either in occasionally passing a common bougie through the fistula, and employing one of larger size in proportion as the dilatation of the obstruction allows, or else in introducing, at proper intervals, one armed with the argent nitrat. See Fréct. Obs. on Strictures, &c.

Spasmodic fistula of the cesophagus have received much benefit from the use of blisters. In other instances we have the highest opinion of the good effects of elastic gum bougies or catheters, as recommended by the continental surgeons. Such instruments at once prevent all necessity for any action in the diseased part, and operate mechanically by their prelure in producing an aborption of the fistula.

Strictures in the Uretbra. See Uretbra.

Stridor Dentum, a grinding of the teeth. Proper Alpinus, in his treatise De Praefer. Vit. et Mort. Aegrot., tells us, that a stridor dentum, which he calls a convulsion of the teeth, has been frequently observed to be a mortal symptom; and he confirms his observations by the authority of Hippocrates.

Striga, in Botany, so called by Lourêiro, from the slender and spare habit of the plant, appears, by the description of that writer, not to be distinct from the Hopea of Vahl and Willdenow; see that article. Indeed it appears to be the very same species, as far as we can judge from the materials before us.

Striga, among the Romans, a space or interval in a crop, a hum of feet long and fifty feet broad, used for currying and rubbing down the horses.

Striga is also used for a furrow drawn out at length, for a long row, or series of any thing, and by surveyors for a long measure.

Strigau, in Geography, a town of Sileia, in the principality of Schweinitz; 9 miles N.W. of Schweinitz. N. lat. 50° 50'. E. long. 16° 22'.

Strigel, Victorinus, in Biography, a German divine, and one of Luther's early disciples, was born at Krautheim in 1554. He studied at Friburg and Wittenberg, and at the latter place took his degree of master of arts in 1554, and, by the advice of Melanchthon, then commenced a course of lectures. But the war obliged him to remove to Magdeburg; thence he went to Frankfort, and in 1548 was made professor of theology at Jena. In 1555 he attended the controversy concerning good works at Eifenach; and taking part in a dispute with Flacius concerning free will, he was imprisoned on account of it at Leuchtenburg; but after some time he obtained his liberty, and permission to teach again at Jena. Soon after he removed to Leipzig; next to Amberg; and then to Heidelberg, where an apoplexy terminated his life in the year 1560. His works, besides poems, consist chiefly of commentaries on various parts of the Bible. He also wrote "Annotations on Josephus, Justin, Ariote, and Cicero;" edited "Oraciones veteres Graeci de Gloria Ecclesiae;" "Theodoreti Dialogi III. Gr. et Lat.;" and "Basilii Hexameron." He was also author of "Ratio legendi scripta Prophetaet et Apostolorum;" and of a Latin version of the Book of Wisdom, which is inserted in "J. A. Fabricii Codex Vet. Test. Pseudoepigraphus." A long dissertation on the life and writings of Strigel was published by C. E. Weismann at Tubingen, in 1732. Gen. Biog.

Strigendorf, in Geography, a town of Sileia, in the principality of Neisse; 5 miles S.W. of Grotkau.

Striges, in the Ancient Architecture, are what in the modern we call string.
They were thus denominated, as being supposed to have been originally intended to imitate the folds or plaitis in women's robes; which the Latin calls friga. The fillets or plaitis between them were called fride.

STREGGO, ALESSANDRO, in Biography, a Florentine gentleman and musical composer in the service of the grand duke Cosimo II. of Medici. He was a lutenist and voluminous composer of music of various kinds, but chiefly vocal. Morley frequently mentions and cites him in his Introduction. He is much commended by Garzoni in his "Piazza Universale," and by the historians of Italian poetry, Credi and Quadro, as one of the earliest composers of music in Italy for the stage. In the preface to "Defcrizione degli intermedi fatti nel palazzo del gran Duce Cosimo," persons were in the presence of the Grand Duke, to see and hear the music of the affectations of the nobility, called eccentri a ufficiale, l'anno 1563; it is said that the music to these interludes, which seem to have been only madrigals, was set by Alessandro Striggio, nobilissimo gentiluomo Mantovano.

His madrigals, in six parts, were published at Venice in 1566. A copy of these is preserved in the Christchurch collection at Oxford. Some of them, however, were printed seven years earlier in the 200 Libro de le Mule, from which we offenses several in the British Museum; but we do not find them remarkable either for genius or science. There seems an attempt at irregularity, in accelerating the parts, but cleerness is wanting in the harmony, and accent in the melody; the subjects of imitation were neither new nor striking at the time they were composed; and the modulation is almost wholly confined to two keys. Compared with the best compositions of his time, they would only be allowed, perhaps, to be good for a dilettante.

STRIGLIL, an instrument used among the ancients in their baths, and at some of their gymnastic exercises.

It served to abrade the sweat, or other fowds, from the body. Persons who entered the baths, or to ufe any of these exercifes, when they entered the gymnasium, put off their clothes in the apodyterium; after which, such of them as intended to box, wrestle, or to ufe any of the more violent exercifes, went into the apodyterium, where they were anointed, and thence returning into the place where the dust was, they were sprinkled with this as they padded along, and then entered upon their several exercifes; after this they returned to the apodyterium, where they had the sweat and fowds wiped off from their bodies by the alpita with an iron sponge.

The fowds taken off from the body, and confisting of oil, dust, and sweat, were preferred for medicinal purpofes, and we find them used among the old physicians.

The frigilis were of the shape of a gardener's knife; they were made of different materials, as ivory, horn, gold, silver, iron, bras, and the like; but in some after-times the word was only used to signify a linen cloth, or a piece of fpunge, which every one carried about him for his own ufe. The fowds, faved for medicinal purpofes, were called frigilis.


Gen. Ch. Cal. Perianth inferior, of one leaf, bell-shaped, with five small teeth. Cor. of one petal; tube cylindrical, the length of the calyx; limb in five deep, linear-oblong, apparently but slightly spreading segments. Nechier a short cylindrical tube, of one leaf, hairy at the summit, bearing the anthers. Stam. Filaments scarcely any, except the necular be fo consider'd; anthers ten, erect, linear, beaksprinkled on the inner surface with faxy hairs. Pet. German superior, ovate; style triangular, the length of the stamens; stigma three, prominent, globose, combined. Peric. Capsule of six cells. Seed solitary.

Ed. Ch. Calyx five-toothed. Corolla in five deep segments. Nechier tubular, shorter than the tube of the corolla, hairy, bearing the stamens. Anthers linear, erect. Fruit of six cells, with solitary seeds.


Gathered by Joseph de Jussieu in Peru. Cavanielles describes it from one of his dried specimens. The stem is thrubby, with round, downy, rubsy, leafy branches. Leaves alternate, elliptical, entire, three or four inches long, single-rinded, veinly, on short thick stalks; smooth above, clothed with reddish down beneath. Flowers in axillary simple clusters, shorter than the leaves. Ripe fruit unknown.

STRIGMENTUM, the fifth, dirt, or fowds, abformed from the skins of those that bathed in the baths and places of public exercices among the ancients, or from the walls of bathing-places, or statues set up in them.

These were all referred for medicinal purpofes, and were procured by three kinds of means; the first or bath fragments, consisted of the sweat, oil, and fowds, collected in those places. The second kind was the ftrigments of the paiftra, consisting of the fame things, with the addition of dust, which was thrown upon the bodies of the persons before they entered on those exercices. The third kind was that collected from the walls of the gymnasium, and from the statues, of whatever materials they were made, which were placed there. Hence the nature of the first and second kinds might always be ascertained, but that of the third was very different; for as it was often collected from brafs and copper statues, it partook of the nature of the tract, or erus, of those metals which were collected from them with it.

These fragments were suppos'd to be of a heating, drying quality, and difficult; they were, therefore, used for dissolving the parotides, and for condyloplastis of the anus. Those of the paiftra were used to diffuse collections of matter about the joints; and applied in the manner of a cataplasm, were said to be of great use in the fcaffitias; and those collected from the walls and statues were used to clean old ulcers.

STRIGONIENSIS TERRA, earth of Strigonium, in the Materia Medica, a red earth of the bole-kind, found about the gold-mines of Strigonium in Hungary, and used in some places as an astringent and vulneraric.

The characters by which it is known from the other earths are these. It is but of a coarse and impure texture, and lighter than most of the boles; in colour it is of a strong but dull red, and is of a tolerably smooth surface. It is apt to crumble to pieces between the fingers, and dries the skin in handling. It melts freely in the mouth, and has a remarkable smoothness, but very little the disagreeableness in its taste, and leaves a sensible grittiness between the teeth. It is sometimes veined and spotted with small molecule of an earth, like the white varieties of the red French bole. It makes a slight effervescence with aqua fortis, or any other acid menstruum, and suffers no change of colour by burning. Hill.

STRIGOSULA, in Natural History, a name given by Mr. Lhuyd to a species of fowble-oyster-shell.

STRIGOSA, in Geography, a town of Hungary, situated in a valley betwixt hills covered with vines, supposed to
to be the ancient "Strigonium," where St. Jerom was born; 8 miles W.N.W. of Clakatharn.

STRIKE, in Commerce, a measure of corn in London, &c. of which are = 80 buhelles = 20 cooms = 10 quarters = 2 ways = a last.

STRIKE is also a measure containing four buhelles; two of which make a quarter.

A strike of flax is as much as can be heckled at once.

STRIKE, or STRIKING, is a sea-word, variously used. When a ship in a fight, or upon meeting with a man of war, lets down, or lowers her toptails, at least half-mast high, they say, She strikes: meaning, the yields or submits, or pays her devoir to that man of war, as the paffes by. See JERMO, SAIL, and SALUTE.

When a top-mast is to be taken down, they say, Strike the top-mast.

And when anything is let down or lowered into the hold, they call it striking down into the hold.

Also, when a ship touches ground in a foal-water, they say, She strikes.

STRIKING a Hull. See HULL.

STRIKING a Nell. In the Manage, is to drive through the horse’s shoe, and the horn or hoof of his foot, and to rivet it for holding on the shoe.

STRIKING a Vin. See BAR.

STRIKING. The punishment appointed by our laws, 23 Hen. VIII. c. 6, for striking in the king’s palace, where his royal person refines, by which blood is drawn, is perpetual imprisonment, and fine at the king’s pleasure; and also loss of the offender’s right hand, the solemn execution of which sentence is preferred in the statute at length. See Lord-STEWARD.

But striking in the king’s superior courts of justice, in Westminister-hall, or at the assizes, is made still more penal than even in the king’s palace. By the ancient common law, before the Conquest, striking in the king’s courts of justice, or drawing a sword therein, was a capital felony; and by our modern law, a strike or a blow in such court of justice, whether blood be drawn or not, or even assaulting a judge, sitting in the court, by drawing a weapon, without any blow struck, is punishable with the loss of the right hand, imprisonment for life, and forfeiture of goods and chattels, and of the profits of his lands during life.

By 5 & 6 Edw. VI. cap. 4, if any person shall maliciously strike another with any weapon, in any church or church-yard, or shall draw any weapon with an intent to strike another with it, he shall upon conviction, by verdict of twelve men, or by his own confession, or by two lawful witnesses, at the assizes or féemes, be adjudged to have one of his ears cut off; and if he have no ears, he shall be burned in the cheek with a hot iron, having the letter F, by which he may be known for a fray-maker and fighter; and besides shall be ijsa iads excommunicated.

STRIKING or PITHING of Animals, in Rural Economy, the method of suddenly slaughtereth or killing them for domestic purposes, by the use of a small sharp spear-pointed knife struck in to as to divide the spinal marrow, instead of the more painless and cruel practice of knocking them on the heads, and breaking and mashing the parts by means of the hammer-headed axe, as is generally the custom, to the great danger of the operator, and the disgust of the spectator. See PITHING.

It is deplorable, on several accounts, that this sudden mode of killing near cattle, and other forts of animals, by striking into and dividing this vital part, should become the common one in all slaughter-houses, and other places; and, especially, as removing the apparent cruelty, and lessening the sufferings of them, more than in the other or the ordinary practice. This method, which has long been universal, in a great measure, on the continent, especially in Portugal, Spain, and some other parts, as well as in some of the West Indian islands in our possession, has, within these few years, been tried in this country, in some instances, with complete success; and the flesh of the beasts so killed has been found equally good, if not better, than that of those slaughtered in the usual manner; and that as the operation is capable of being performed quietly, and without any sort of alarm to the animals, all accidents and bruises are avoided, which not uncommonly take place in forcing them into a proper situation and position, for receiving the stroke or blow, when they are to be knocked down, and killed in that way.

It has been stated by the writer of the Corrected Report of the Agriculture of Shropshire, that a butcher at Wifbeach, in Lincolnshire, practiced this mode several years ago, in consequence of the representations made to him of it, by captain Clarkton of the navy, who had seen animals so slaughtered for the use of our fleet, when at Jamaica: that, after his death, Smyth, another butcher of the same place, adopted the same method: and that, in the year 1796, he (the writer) procured, by favour of Mr. Clarkson, so distinguished for humanity, the following account, which he had from Smith, who informed him, that he killed all his bullocks by striking them in the spinal marrow. The line was drawn by a line on the bend of the neck, about an inch and a half distance from the horns, or places for them, and the centre of this line were found, this center or spot would be the place where the knife should enter, in striking the animals. That the knife which makes use of is not in the form of a dagger, nor is it stricken or thrust in with any great force: it is rather larger than a common penknife, but the blade is permanently fixed in the handle. In the act of striking, the handle is taken into the hand, and the fore-finger placed downwards of it and the blade, towards the point, merely in order to direct it in the operation. The person who uses the knife or instrument takes hold of one ear of the beast with his left hand, while with his right he strikes it in the proper place with the knife or tool. In the same instant the bullock drops, and it apparently out of all sensation of pain. He was informed also, that it is not only in a thousand times that any person misfles the right place; though perhaps an apprentice or foreman may at first, or in the beginning. But the rule, on the whole, is so certain, that it may be laid hardly ever to fail. However, if it should at any time, the knife is at least fo near the proper place, that by the smallest motion or alteration of its position, without withdrawing it, it may find its proper way, and finish the work. In this case, it is supposed, there would hardly be the pain of two seconds to the animals. However, in speaking to Smith’s apprentice on the subject, he was assured by him, that he had no difficulty in finding the proper spot for the purpose, and that the beasts drop instantly. This practice obtains pretty generally on the Lincolnshire side or bank of the Humber river, as at Barton, and several other places. Calves, sheep, pigs, and other animals, are flayed to have been killed in the same manner.

Notwithstanding this account, the want of due precision in the manner of performing the operation has prevented, or thrown some doubt upon its utility, especially in so far as tenderness and humanity towards the animal are concerned; for though the beast may be managed completely by this mode of performing the operation, yet, without sufficient correctness and exactness in its execution, it is not so certain that
that its sense of feeling may be wholly destroyed. Indeed the contrary would seem to be the case, from the ingenious and well directed inquiries and experimental trials of Dr. Du Gard of Shrewsbury, who has shown, that though the spinal marrow may be divided, the nerves that supply the organs of respiration and most of the sensory remain uninjured. But if the division be made sufficiently high up towards the cavity of the skull, so as to separate the medullary substance above the origin of the nerves which supply the diaphragm, it would appear, from the equally ingenious and correct experiments of others, as Hunter, Home, &c. that the animals may infallibly be killed in the most certain and effectual manner; and that by performing this operation in the same way, it will be attended with constancy and perfect success.

It is not improbable, indeed, that an instrument might be contrived by means of a strong spring, somewhat in the manner of that used in cupping, but only with one blade, that might, on being properly applied, force itself suddenly into the brain even, and thus infallibly complete the business; or the operation might probably be performed in an equally complete, convenient, and more expeditious manner, by the discharge of a small pistol, loaded in some proper way for this purpose, and suitably directed.

In some of these ways the present brutal, beating, hammering, and disgusting practice may probably be got quit of, which, for many reasons, is highly desirable, and that although the practical utility of such distempers, in a disease which is so speedily fatal, may not be immediately apparent, it is necessary to notice them, that by particularly observing the other morbid changes with which they are sometimes or always accompanied, the appearances which affected the animals while alive, and the circumstances which preceded the attack, a perfect history and knowledge of all the forms and variations of this very destructive disease may be obtained.

Some think that, besides the above noticed parts, the heart, lungs, and liver, sometimes the pancreas is primarily affected in this disease, as easily perceived by the dark and livid appearance of the peculiarly affected part; and the body becomes swollen, in some cases, with a collection of air in the cellular parts and belly.

In each of these two divisions, classes, or kinds of this disorder which have been noticed above, there are several varieties, as below.

The first variety of the first kind, or that of bowels, as it is often called, the stomach being the principal seat of the disease, may be said to be a fort of gastritis; or inflammatory state of that organ. In it the belly is prodigiously swelled, the carcass much discoloured, and a four pituitary matter diffused throughout the whole body, especially the flesh parts of it. The fatty matter appears the least changed; but although it melts down into a greasy state, it has always a bloody appearance, from which, it is said, it cannot be cleared. On opening the body, it emits a strong smell of the sulphureous kind, which is characteristic of the disease, and from which it has sometimes been named, as well as from the place of its chief seat, and the stench and bowels are prodigiously discharge with air, having the same intolerable stench. A general redness pervades the whole bowels. The two first stomachs are rarely the particular seat of the disease, the third only occasionally; but the fourth, and especially that part of it leading to the intestines, known by the name of pylorus, is constantly much thickened, inflamed, or even mortified. The matter of food found in the stomach, especially the third, is mostly quite dry, and may, it is said, be crumbled to powder between the fingers. The kidneys are completely mortified, and
and resemble a mass of putrid gore. The liver too is much affected, but the heart and lungs only partake in some degree of the general redness.

It is remarked, that this is the most common kind of this sort of sicknees, is peculiar to sheep of the hog kind on the first setting in of frost, is not to be distinguished during the life of the animal, but by the excessive swelling of the belly, and is almost always speedily fatal.

Another variety of this kind, that most nearly resembles the above, is that where, instead of the stomach, the small guts are inflamed and mortified, and which may be denominated a sort of enteritis, or inflammation of the bowels.

In this, the carcase is much less swelled, and not nearly so blue and putrid, and, in fact, the chewed griss in the bowels is very stiff, and almost quite solid to the feel; the stomach is scarcely affected in the leaf, but the small intestines are mortified, black, soft, and almost quite rotten, the inflammation having evidently originated in one of the latter folds of the same. In one or two instances, a small fold or doubling in the intestines was noticed, which, by some wind passing through them, had forced its way through the thin texture that covers them, and by which the fat hangs. This was of air, quite black and mortified, as were several of the folds above it. Indeed it is thought to be plausibly enough, conjectured by Mr. J. Hog, a writer on the diseases of sheep, that this variety of the disorder is caused by a twist or intussusception of the intestines, produced by enlarged and hardened lumps of purulent obstructing all passage through them.

It is said only to attack hog-sheep, which have plenty of griss when the weather is mild, during storms of snow, when their walk is much circumscribed, and when they are confined to the tops of the heather, bent, and other dry sapphire food. It is not, it is said, so speedily fatal as the preceding variety of this diseas, and the cloak of the diseas sometimes linger a day or two in great agony, without appearing much swelled. It is sometimes termed the dry brezy.

A third form or variety of this diseas, which has sometimes its chief seat in the urinary bladder, may be considered as a sort of cystitis, or inflammation of that part. The appearances of the disorder, it is said, in this form, resemble those of the first of the above varieties, and that the putrid tant of the carcase is nearly the same.

And in a fourth form or variety of this kind, sometimes in the belly, and being opened, the whole bowels are found swimming in bloody water, although none of it is contained in the intestines. The gall-bladder is contracted and shrunk to a size scarcely to be observed, and is almost empty of bile. The membranes connecting it with the other parts are inflamed. The urinary bladder is always empty, but not found ruptured in the Gates examined by Mr. J. Hog, as he had been to subject the writer on the subject. The smaller apartment of the stomach had some purple spots on it, which were thicker than the rest of its substance. This variety, having the peritoneum, which covers the whole intestines, and lines the cavity of the belly, as the principal seat of the diseas, may be considered as a sort of peritonitis, or inflammation of that membrane or covering.

It is said that it may be known, during the life of the animal, by the swelling hanging low, instead of rising up at each side of the back, as in the first of the above varieties, and by an evident feeling of fluctuation, when the one hand is applied flat to one side of the belly, while the opposite side is struck by the palm of the other hand.

In the fifth variety of the second division or kind of this diseas, often termed sicknees in the first and blood, or the fifth of the whole diseas, in some instances, and those the most violent, no one part of the stomach or bowels seems, it is said, to be more affected than another. There is a general redness over the whole, and the flesh of the animal is quite tender and soft, soon assuming a greenish hue. In this case, the disorder may be said to be a sort of phrenitis, or inflammation of the brain, which partakes of the affection, and the vesseles of which are red and turbid, exhibiting, with the exception of the blacknees, the same appearance as that mentioned in the bowels. In all cases where this is observed after death, the diseas, it is said, has been very quickly fatal, seldom exceeding four, or at most six hours from the first apparent affection of the animal.

Another variety of this nature, which is the fifth of the diseas, or that sort of sicknees which is fested in the bowels, is not so readily discerned in the living animal; nor does it affect the carcase so much, it is said, if blood be let. There seems to be a tendency, it is thought, in the blood itself to decompose and putrefy, and not unfrequently there are appearances of inflammation on the membranous coat that lines the breast, when the diseas may be said to be a sort of pleuritis; or on the diaphragm, when it may be termed a diaphragmatitis; and the distemper on the whole has a strong resemblance to pleurisy.

In these two varieties of this kind, whether they be distinct ones or not, the whole body is said by Mr. J. Hog to be bowed and swelled like a loaf; that the fore-legs are certainly the worst; that the kidneys are in the same state of mortification as in the two first of the above or varieties; that the appearances and the smell are the same; that the sheep are carried off by it in the same short space of time; and that it is the same as the black sheald in young cattle beginning to feed on fodder and dry herbage, when the grasses fail in the west of Scotland. It is also noticed, that all the old sheep and lambs are most affected, although the hogs that fall in May, are carried off by this sort or variety of the diseas, although individuals die of it at the same feast, when they are dying in great numbers of the bowel-sicknees. But that, on the whole, the mortality is not nearly so great, not indeed above one-tenth or one-twentieth of that occasioned by the other.

In respect to the causes of the diseas, although some few old sheep and lambs may occasionally perish and be destroyed by it, it may be considered, on the whole, as a diseas pecu-

nary, and that the founder these are bred, and the higher condition they are in, the more apt it is to break out among them, the more violent are its ravages, and the sooner do they die when attacked by it. Heath sheep too are supposed to suffer more from it than the white-faced and fine-wooled breed. On setting in feversly, it not unfrequently carries off one-tenth of the young sheep. But it is not half so fatal by the plan of pasturing the hogs with their mothers, it is said, as that of herfelling or rearing them by themselves, on account of the differences in their habits which are thus produced. Though some sheep die of the diseas at all feasons, its ravages are chiefly confined to the winter months, commencing sooner or later, as the state of the weather may be. But it seldom prevails much until after the vegetation has been checked by the early autumn frost; and is the most destractive towards the close of the year: when at that period there is any sudden change from mild to frosty weather, or if rain in the day be succeeded by frost in the night, and especially when accompanied by hoar-frost, it is, it is said, particularly fatal. It becomes less frequent after steady frost sets in, but again carries off a few towards the

end
end of the spring, and some suppose the deaths more frequent a day or two before the change in the weather actually takes place.

The disease may be immediately caused or brought on by means of frozen grafts. The spots of ground where frolick mists settle deep on the softer grasses, are, it is said, very dangerous for young sheep to feed and lie upon, as well as those of dry pastures, which are heavily loaded with hoarfrost. The effects of grafts eaten in this state, on the tender bowels of hog-sheep, resemble, it is supposed, those of frozen potatoes eaten by black cattle, which immediately engender prodigious quantities of noxious gales, and quickly bring on inflammation and mortification.

The necroticity of sheep working and eating on places, already bared and fouled, in heavy storms of snow, is another immediate, and not unfrequently destructive cause of the disease, as in these circumstances they eat any thing that comes in their way, as rotten fern, fog, roots, spratt, and other coarse plants, or whatever they can get at.

Some have supposed that pet sheep, and those that have shelter in the night-time, are seldom affected by it; but it has been asserted by Mr. J. Hog, that he has seen many instances of domestic sheep, termed petty, dying of the disease; and that in some northern districts, where the small flocks of sheep are nightly housed the year round in fear of frosts, it rages with uncommon ferocity.

In regard to soils or grounds, those which are barren, dry, and unfenced, such as the ley heathery kind, are the most liable to have the sheep affected with the disease. But all kinds of pastures, which have one part of the herbage fine, and the other coarse, are liable to cause the disease, and to have great loss from it. Those likewise which have a sweet juicy food in a flosed and impure condition in different parts of them, or spots of luxuriant grafts, and that of sheep tallow, as old walks, and other places, are very dangerous. The animals nauteate tallow-grafs, it is said, uninjured by the frost, when they eat it in quantities evidently dangerous to them. Where the food that is produced is in the most confluent state of fat growth, the sheep in the pastures are the most safe from this disease.

In respect to the cure of the disease, in consequence of the fuddledness of its attack and fatality, it is probably almost impossible, as nearly one half the sheep attacked by it, are said to be dead before they are discovered to have been affected. Notwithstanding this, however, a great number of remedies for it have been proposed at different times, and highly extolled for the certainty of their success; but they have been found of little avail. Some of them, indeed, have contributed to aggravate the disease rather than to remove it, as those of the spirituous, mustard, and some other kinds. But if, in any instance, a cure is at all possible, it can only be effected, it is said, by such means as are calculated to counteract and remove inflammation, and those employed in the very infant or onset of the disorder. Of these means, blood-letting is perhaps chiefly to be depended upon, and the veins in the tail, on the sides of the forelegs, and the stables of the eyes, may be opened for the purpose.

At the first symptoms of the cooling refrigerant kind, such as nitre, and cathartic purging ones of the saline fort, with caftor oil, infusions of lenses, and others of a similar nature, may be given; and proper crytlers may be thrown up, in some cafes, with more effect: when, if the bleeding should be full and free, and the purging or evacuation of the bowels suitable, some hopes of the recovery of the animal may be entertained. When the sheep do recover, they are however always weak, and require much care and attention to get them through the winter feason.

Another mode of treatment for this disease has been advised by Mr. J. Hog, on the ground of actual experience, but which appears very inconsistent and improper. This is, in the first place, if the animal be found in time, to give it a severe heat, by running it: if this be not successful, he knows nothing that will. It is to be so well hunted, as that it does not immediately afterwards lie down on leaving it, or if this be the case, it should be in the house. This means has been discovered by chance, it is thought, but has not been properly acknowledged.

Bathing in warm water for ten or eight minutes at least, has also been recommended; after which a quantity of water-gruel, mixed with butter or some other soothing ingredient, may be administered as an injection or otherwise.

Great care is, however, to be taken that none of these means are used in the fourth of the above varieties of the disease, or that of the watery kind, as they occasion infant death.

Much more is, however, to be done by the means of prevention than those of cure in this complaint. These are many, such as the proper plans of managing the young hog-sheep in rearing them, as has been seen above; the preserving the vegetation of the pasture herbage as much as possible by proper stocking and feeding such lands; the providing proper supplies of green succulent food for the stock; the proper moderate use of turnips, as by this means the losses by the disease have been greatly prevented and lessened in different cafes; the sheltering and protecting them well; the net allowing them to be over-heated by exertion; the careful removal of all forts of coarse rank grafts in the pastures; the destruction of the ley heather in the winter hog-pastures by burning or other means; the moving the sheep about early in the morning; the bleaching the hog-sheep previously to the season of the disease attacking them a small extent; and some others. Many think great advantages are derived in this way, by pasturing the young and old sheep of the flocks all together, as by such a mode the disease has been almost wholly eradicated, and prevented where it had been introduced. And that great benefit arises from having the pasture-grounds for the sheep, especially the hogs, all of the same quality or kind, whatever it may be. These several points are fully considered and explained in an excellent paper on this disease, inserted in the third volume of the "Transactions of the Highland Society of Scotland," by A. Duncan junior, M.D., to which the inquirer is referred.

**Striking off Wheat-Leaves, or Flagging, a practice or operation performed in some districts, as in Ayr, for thinning and clearing away the large broad leaves of strong full wheat-crops. In executing this sort of work, the men, with fickle or reaping-hooks that have sharp edges, when these crops are very heavy, with broad luxuriant leaves, move regularly through the fields of them, and strike off many of these leaves, in order to lighten the tops of the plants, with the view of preventing their being beaten down by rain. It should, it is said, be done carefully, or damage may ensue from it. This curious practice is, however, very little known or employed in other districts, and probably but seldom necessary in any cafes.**

**Striking off Above-Mill Machine, an instrument or machine contrived for the purpose of striking off or clearing pasture-grounds of these sorts of hills, which are sometimes very injurious**
injuriously and troublesome in them. It consists of a sort of
strong wooden frame, about five feet by four in the square,
which has handles behind, and is rounded off a little in the
front parts, in order to be drawn along the surface of the
land with facility; having the under parts set with a kind of
coulters or cutting-blades, which readily flake and take off
the hills as it moves along, in an even and neat manner.

A representation of it may be seen in the first volume of
the Corrected Report of the State of the Agriculture of the
County of Middlesex, published by the Board. [\textit{Striking or Suckling of Hemp and Flax, in Rural Eco-}
\textit{nomy}, the means of beating and preparing them over the
wooden rump or flock, so as to render them soft, and clear
of the shaves or shawy matters that hang about them.
[\textit{Striking of Meat}, the practice or first operation in curing
it with salt. The smallest-faced sort of salt is thought to
be the best for this purpose, whether it is in the dry
or moist manner. See \textit{Salt}.

\textit{Striking-Watch}. See \textit{Watch}.

\textit{Striking-Wheel}, a clock, the fame with which
by some is called the pin-wheel, because of the pins
which are placed on the round or rim, (which in number are the quo-
tient of the pinion divided by the pinion of the detent-wheel.)
In sixteen-day clocks, the first, or great wheel, is usu-
ally the pin-wheel; but in such as go eight days, the second
wheel is the pin-wheel, or striking-wheel. See \textit{Clockwork}.

\textit{Strilek}, in \textit{Geography}, a town of Moravia, in the
circle of Hradisch; 14 miles N.W. of Hradisch.

\textit{Strillozza}, in \textit{Ornithology}, a name by which some
authors have called the \textit{emberiza alta}, or bunting, or per-
haps a bird somewhat different from our bunting, and com-
mon in Italy; for it is not yet ascertained, whether the stril-
lozza specifically differs from the bunting, or only by some
accidental variegations.

\textit{Strimba}, in \textit{Geography}, a town of European Tur-
key, in Moldavia; 18 miles N.W. of Birlat.

\textit{Strimiz}, a town of Bohemia, in the circle of Leit-
meritz; 18 miles W. of Leitmeritz.

\textit{Strimon}, or \textit{Emboli}, a river of European Turkey,
in Romania, which runs into the gulf of Contoza, 6 miles
S. of Enyros.

\textit{Strindlen}, a town of Norway, in the province of
Droneheim; 3 miles N.E. of Droneheim.

\textit{String}, in \textit{Music}. See \textit{Chord}.

If two strings or chords of a musical instrument only differ
in length, their tones, that is, the number of vibrations
they make in the same time, are in the inverse ratio of their
lengths. If they only differ in thickness, their tones are in
the inverse ratio of their diameters. As to the tension of
strings, to measure it regularly, they must be considered
fretched or drawn by weights; and then, \textit{ceteris paribus},
the tones of two strings are in a direct ratio of the square
roots of the weights which fret them; that is, \( c_1 e \), the
tone of a string fretted by a weight \( 4_1 \), is an octave above
the tone of a string fretted by the weight \( 1 \).

It is an observation of very old standing, that if a viol or
lute-string be touched with the bow, or hand, another string
on the same, or another instrument, not far from it, if in
unison to it, or in octaves, or the like, will at the same time
tremble of its own accord. See \textit{Unison}.

But it is now found, that not the whole of that other string
thus trembles, but the several parts, severally, according as
they are unisons to the whole, or the parts of the string for
which. Thus, supposing \( A B \) to be an \( A \) and \( B 
\) upper octave to \( c \), and therefore an \( c \) unison to each half of it, stopped at \( b \);

\begin{align*}
1 & 1 & 1 \\
2 & b & 2
\end{align*}

If, while \( a \) is open, \( A B \) be struck, the two halves of this
other, that is, \( a b \) and \( b c \), will both tremble; but the
middle point will be at rest; as will be easily perceived,
by wrapping a bit of paper lightly about the string \( a c \), and re-
moving it successively from one end of the string to the other.
In like manner, if \( A B \) were an upper twelfth to \( a c \), and,
consequently, an unison to its three parts \( a 1, 1 2, \) and \( 2 c 
\); if, \( a c \) being open, \( A B \) be struck, its three parts \( 1, 1 2, \) and \( 2 c \), will severally tremble; but the points \( 1 \) and \( 2 \) remain
at rest. This, Dr. Wallis tells us, was first discovered by
William Noble, of Wadham College; and after him, by Mr.
T. Pigot, of Wadham college, without knowing that Mr.
Noble had observed it before. To which we may add,
that M. Sauveur, long afterwards, proposed it to the Royal
Academy, at Paris, as his own discovery, as it is like
enough it might be; but upon his being informed, by some
of the members then present, that Dr. Wallis had pub-
lished it before, he immediately resigned all the honour

This phenomenon is better explained under the articles
\textit{Harmonique}, \textit{Vibrations}, \textit{Fundamental}, and
\textit{Genera}.

We shall add to the article \textit{Strings}, musically consi-
dered, D'Alembert's definition of the term \textit{corde fonore} in the
original edition of the Encyclopédie, and copied by Rousseau
in his \textit{Dictionaire de la Musique}.

\textit{Corde fonore} is any string fretted
right, whence a musical tone can be produced.

"If a string is screwed tight in any one of its parts, it
moves to a certain distance from the right line it formed in
its quiescent state, returning afterwards, and vibrating back
and forwards, by its elasticity, like a pendulum put in motion.
Further, if this string is of a substance equally elastic in
all its parts, so that the undulation is communi-
cated to the whole string, in vibrating it will produce a
sound, and its sound will always accompany its vibrations.

Geometrical have discovered the laws of these vibrations,
and musicians those of the sounds which they produce.

"It has been long known by experience, and, to a certain
degree, by reason, that, \textit{ceteris paribus}, strings vibrate with
more or less rapidity, in proportion to their length; that is
to say, the ratio of their lengths is always inerse to that
of the number of the vibrations. Dr. Taylor, a celebrated
English geometer, was the first who demonstrated
the laws of the vibrations of strings with exactitude, in his
learned work, entitled "Methodus incrementorum directa
et invera," 1715; and these fame laws have likewise been
demonstrated by John Bernoulli, in the second volume of the
"Memoires de l'Acad. Imperial de Petersbourg."

From the formula (adds Rousseau) which results from
these laws, and which may be found in the Encyclopédie,
art, \textit{Cordes}, I shall draw the corollaries following, which
serve as principles to the theory of music.

1. If two strings of the same matter are equal in length
and thickens, the number of the vibrations in equal times will
be as the roots of the numbers which express the ratio of the
tension of strings.

2. If the tensions and the lengths are equal, the number
of the vibrations in equal times will be in the inverse ratio of
their thickens, or diameter of the string.

3. If the tension and thickens are equal, the number of
vibrations in equal times will be in the inverse ratio of their
lengths.

For the intelligence of these theorems, it seems neces-
sary to observe, that the tension of the strings is not repre-
sented by the weight or press为客户生成的文本内容。
From the laws of the vibrations of strings, are deduced those of the sounds which result from them. The more vibrations a string makes in a given time, the more acute is the sound; and the fewer vibrations a string makes, the more grave it is. So that sounds reciprocally follow their vibrations; their intervals are expressed by the same ratios, which reduces all music to calculation.

It appears by the preceding theorems, that there are three ways of changing the tone of a string: namely, the length, thickness, and tension. What these alterations produce successively upon the same string, may be produced at once on different strings, in giving them different degrees of length, thickness, and tension. This method combined is that which is practised in the fabrication and tuning of all stringed instruments, relative to the fixed length of the strings by pins and bridges, or the changeable lengths by pegs and a nut; and the pressure of the fingers, which act like moveable bridges of a monochord. See Harmonics.

Another property, not less surprising, of a tuneable string is, that if the finger which divides it into its aliquot parts touch the string lightly, without pressing it down to the finger-board, and a part of its vibrations are suffered to be communicated to the upper portion of the string, at such time, instead of the whole string sounding, or the usual part of it next the bridge, the found only of the greatest common aliquot will be heard. See Harmonics.

The word corde, in French, is used frequently in compositions for the fundamental sounds of the key; and the dispositions which alter the modulation in the baie, or prolong a phrase, are often called harmonic chords.

Strings, in Ship-Building, is a brake or frakes withinside, under the gunwale, and answering to the sheer-frakes without-side: it is scarified in the name manner as the sheer-frake, and bolted through the ship's side into the sheer-frake between the drifts, for the purpose of greater strength, as this part requires all the security that is possible to be given, in order to affit the sheer.

Strings of Metal, a term used by our miners to express those thin and small veins of ore, into which the beds or veins degenerate toward their terminations. These are from an inch to a tenth part of an inch in thickness, and run through the solid rocks to a great distance. The ore in them is usually very pure and rich, and as they lie in the rocks, communicating with the larger veins of ore, they resemble the several small brooks and rivulets in a hilly country, which by degrees uniting all their streams, form the rivers.

STRING-HALT; among Horset, an involuntary and convulsive motion of the muscles, which extend or bend the hough. When it seizes the outside muscles, the horse stumbles, and throws his legs outward; but when the inside muscles are affected, his legs are twitched up to his belly. Sometimes it is only in one leg; sometimes in both. It generally proceeds from some strain or blow, and the removal often is difficult, and seldom attended with success; though, in the beginning, a string-halt may be removed with good rubbing, and the use of fomentations, with daily but moderate exercise. The last refuge is usually the fire, which some say has been known to answer, at least so far as to prevent absolute lameness in particular cases. A similar affection sometimes takes place in that cattle, which is to be removed nearly in the same manner.

STRINSIA, in Ichthyology, a name given by authors to that species of the gadus, which is called by some lota, and by others mystus flavoventris; by us in English the coal-pout. Olaus Magnus calls it the borbolus.

STRIP, at Sea. A chase is said to strip himself into short or fighting fails, when he puts out his colours in the poop; his flag on the main-top; his foremasts or pendants at the end of his yard-arms;furls his sprit-sail; peeks his mixen; and slings his main-yard. In which case, the chaser must prepare himself for fight.

Strip, To, is to unrig a ship, or divert the masts of their machinery and furniture, otherwise called dismantling.

Strip, To, in Rural Economy, a term signifying to drain the raft milk from cows.

Striped Stalk, See Stalk.

Striped Velvet. See Velvet.

Stripping, in Agriculture, a term applied to the operation or practice of scrimming or taking off a thin portion of the surface of lay or other ground, in a fort of alternate manner; a thin flise or piece of the turfy or other surface, to the breadth of from four to five inches, being cut up and turned over on to an adjoining portion of solid surface of the fame breadth, in performing the work: by this means, though the turfy or other surface be half of it stripped or cut up and turned, the whole is completely covered over, presenting a stripped or ribbed-like appearance; which, in some places and districts, is termed ribbing, but in others it has different other names given to it.

This is a practice which is common in most of the southern counties of the kingdom.

Stripping of Hop-Poles, in Rural Economy, the practice of clearing and removing the waffe binds from about them after the hops have been picked, by untwisting and drawing them off from the poles, which is readily executed. It is an operation that should always be performed as soon as possible after the produce has been gathered, as much injury is done to the poles by letting the binds remain long twifled about them while they are lying upon the moist ground. The price of tripping poles of this kind of this fort of incumbrance, is most commonly about three shillings the acre. When the stripping of the poles has been completed, they are ready for being pointed and put up in stacks. See Stacking and Staking of Hop-poles.

Stripping of Paring-Share, in Agriculture, that fort of stripping or paring contrivance which is fixed upon ploughs for the purpose of tripping, paring, or taking off the surface or fward of lay-ground, in some cafes, in breaking it up. It is made in somewhat the manner of a paring-flock, and rendered extremely sharp in the cutting parts or edges. It is formed of different sizes; but has sometimes considerable breadth, and is capable of being put upon different common ploughs. It is a tool or contrivance which is much used in Devonshire and Cornwall, and which may, on different occasions, be found useful, and of considerable benefit in the performance of such fort of work in different other districts of the country. See Sock-Paring.

Strippings, in Rural Economy, a word made use of to signify the last milk of cows, or the frothings or afterlings.

STRITHAGEN, in Geography, a town of France, in the department of the Orte; 8 miles N.W. of Rodluc.

STRIVALE, in Ichthyology, the name used by many for the fish more usually known by the name of aper, the boar-fish.

STRIVALLI, in Geography, two rocky islands in the Mediterranean, anciently called "Strophades," which, according to the representations of the poets, were the abode of the Harpies; now inhabited by a few monks; 46 miles S. of Zante. N. lat. 37° 29'. E. long. 21° 12'.

STRIX, the Owl, in Ornithology, a genus of birds of the order Accipitres; of which the generic character is as follows: Bill hooked, no cere; nostrils oblong, covered with
STRIX.

with bristly recurved feathers; the head, auricles, and eyes, large; the tongue is biform.

The birds of this genus fly abroad by night, and prey on small birds, mice, and bats: their eyes are weak by day, and generally closed, during which time, if discovered, they are pelted by small birds: their legs are usually downy to the toes; outer toe retructile; auricles large, covered with a membrane; outer quill-feathers serrate on each edge; the claws are hooked and tawny.

The alliance between the genus Strix and that of Falco (which see) is extremely strong, so much so, that by some authors, owls have been considered as a kind of nocturnal hawks, differing, as Linnaeus observes, from those birds, in the same manner as moths differ from butterflies; the one being chiefly nocturnal, and the other diurnal. These are separated into two fections, viz.: those that have ears or horns, and those that have none. These horns are lengthened feathers on each side the head, and are capable of being more or less erected, at the pleasure of the bird. To these Dr. Shaw has added another division, under the name of Accipitrine owls, or such as, from their general habit, are more nearly allied to hawks than the others. Gmelin enumerates fifty species, but Dr. Shaw describes more than sixty.

Species.

A. Eared.

Bubo; Great Owl, or Rufous Horned Owl, variegated with black, brown, and ash-coloured spots and freckles. The specific character given by Gmelin is, body tawny. There are three other varieties: 1. Body darker, with blackish wings. 2. Legs naked. 3. Blackish-yellow, variegated with white. This is the largest species of owl, and but little inferior in size to an eagle. Its general colour is rufous or ferruginous, varied with larger and smaller spots and markings of brown, black, and grey; together with innumerable freckles or minute specks of the same colours. It is found of a deeper or lighter hue, according to various circumstances of age, health, and climate: the larger wing and all feathers are obscurely varied by dusky transverse bars; the bill is black, the eyes are very large, and of a bright red or golden orange-colour; the legs are short and strong, thickly clothed, down to the very claws, with fine, downy, and fuscous plumage; the claws are extremely large, strong, and black.

This species, including the varieties above enumerated, appears to be very generally diffused throughout the temperate and northern parts of the old continent, and is even suppos'd to occur both in North and South America. In this country it is rarely seen; in Germany it is rather common. It preys, in the manner of eagles and the larger falcons, on hares, rabbits, and almost all kinds of birds, and builds its nest among the crags of rocks, or among ruined edifices, and lays, as it is suppos'd, rarely more than two eggs, which are larger and rounder than those of a hen, and of a rufous colour, blotched with variegations not much unlike the bird itself.

Owls have usually been regarded as birds of ill omen, and superstitiously considered as messengers of woe. This is the case in the new world as well as the old. The Athenians, among the ancients, seem to have been free from this popular prejudice, and to have regarded the owl with veneration rather than abhorrence, considering it as the favourate of Minerva. The owl thus venerated appears to have been a variety of this species, which is said to be common in many parts of Greece. The Romans viewed the owl with detestation and dread. It was held sacred to Proserpine: its appearance foreboded unfortunate events, and according to Pliny, the city of Rome underwent a solemn purification in consequence of one of these birds having accidentally strayed into the Capitol.

Virginia; Virginia Owl. Body above brown, varied with fine, zigzag, tawny, and cinereous lines; beneath pale-asph, with transverse brown streaks; throat and sides of the breast orange, streaked with brown. This is the constant of America, and is life than the last. According to Mr. Edwards, it approaches in many respects nearly to the greatest horn or eagle owl: the bigness of the head in this seems not at all inferior to that of a cat; the wing, when closed, measures, from the top to the ends of the quills, full fifteen inches; the bill is black, the upper mandible is hooked, and overhanging the hither, as in eagles and hawks, having no angle in them, but plain on its edges; it is covered with a thin, in which are placed the nostrils, and that skin hidden with a finely kind of grey feathers, that grow round the back of the bill; the eyes are large, having circles round them, broad, of a bright shining gold-colour; the space round the eyes, which may be called the face, is of a light brown colour, confusedly mixed with orange, gradually becoming dusky where it borders on the eyes; over the eyes it has white strokes; the feathers that compose the horns begin just above the bill, where they are intermixed with a little white, but as they extend onwards beyond the head, they become of a red-brown, clouded with dusky, and tipped with black; the top of the head, neck, wings, and upper side of the tail, are barred across with bars of dusky-redish; the greater wing-feathers and the tail are barred across with dusky bars of half an inch in breadth; the feathers between the back and wings are orange-coloured, tipped with white; the fore-part of the neck and back are bright brown, inclining to orange, which grows fainter on the sides; this brown part is spotted with pretty large dark spots; the middle of the breast, belly, thighs, and under-side of the tail, are white, or faint ash-colour, barred transversely with dusky lines pretty regularly; the inside of the wings is coloured and variegated to the same manner; the legs and toes, almost to the ends, are covered with light ash-coloured feathers; the ends of the toes and claws are of a dark horn-colour.

This species occasionally varies in the cast of its colours, which are sometimes darker, with fewer variegations in its plumage. It is found in North America, as high as Hudson's Bay, frequenting woody districts, and uttering, it is said, a most hideous noise in the woods, not unlike the howling of a man, so that passengers, beguiled by it, sometimes lose their way.

Scandinacia; Scandinavian Owl. Body whitish, with black spots. It inhabits the mountains of Lapland, and is the size of a turkey.

Zeylonensis; Ceylon Owl. Body above reddish-brown, beneath yellowish-white; circles on the face reddish-brown, streaked with black. It is, as its name denotes, an inhabitant of Ceylon, where it is called Rusa Aha. The length of this species is nearly two feet, and its weight about two pounds and three quarters. The bill is horn-coloured; the irida yellow; the upper parts of the bill of a pale reddish-brown; the under parts yellowish-white; each feather appearing to be streaked and barred with a dusky-black; the ears of the horns are short and pointed; the prime quills and tail are barred with black, white, and pale-red.

Sinensis; Chinese Owl. Body reddish-brown, with waved black lines, beneath streaked with reddish-black, and barred with white. It inhabits China: the bill and legs
legs are black; secondary quill-feathers with four blackish bars.

Coromanda; Coromandel Owl. Body above greyish-red, with reddish-white spots; beneath pale-red, with small semilunar black spots. It is found in India. The bill is black; the irides yellow; legs reddish; cheeks white; quill and tail feathers barred with reddish-white.

Ario; Red Owl. Body above ferruginous, beneath cinereous; wings with five white dots. It is not quite a foot long. It inhabits New York, and as low as the Carolinas; and lives in the woods near the coast. The female is said to differ in being brown and ferruginous.

Mexicana; Mexican Owl. Body variegated with brown and black. It inhabits Mexico, where it is called by the name of Ticonde. Its colour is a variegation of black and brown.

American; American Owl. Head and body above cinereous, beneath rufous; rump white, spotted with black; wings and tail rufous, with cinereous and grey tranverse lines. This is an inhabitant of America, and is supposed by Buffon to be a variety of S. otus, which is the next to be described.

Otus; Long-eared Owl. This, in its general appearance, is very strikingly allied to the S. subo, but in size it is far inferior. It is about fourteen inches and a half in length. The general cast of the colours inclines more to ferruginous on the breast and underparts, with a mixture of white in the front of the head and thighs. This bird is fond of woody and rocky solitudes, and is not observed to build any nest of its own, but contents itself with a deft nest of a butcher or magpie, and usually lays five eggs. The young are at first entirely covered with white down, and begin to acquire their colours at the expiration of about fifteen days. In several parts of Italy is found a variety of this bird, which differs in being somewhat larger, and in having the plumage mixed or varied in a considerable degree with ash-colour; the bend of the wing and the coverts white, and the tail is marked with zigzag black lines. The long-eared owl is considered as a pretty general inhabitant of Europe, and though far less common in our own country than some other species, it is not of uncommon occurrence. In North America it is found to inhabit the woods at a distance from the sea-coast, and has been observed at Hudson's Bay, preying chiefly on birds, with much cunning; and often approaches the dwellings of the inhabitants.

Brachytoon; Short-eared Owl. Horns short; body above brown; the feathers edged with yellow; beneath pale-yellow, longitudinally streaked with dusky. This species is found in our country, in divers other parts of Europe, also in America and Siberia. This bird was first accurately described by Mr. Pennant, whose account is as follows. The length of the short-eared owl is about fourteen inches; the extent is three feet; the head is small and hawk-like; the bill is dusky; weight fourteen ounces; the circle of feathers that immediately surrounds the eyes is black; the larger circle is white, terminated with tawny and black; the feathers on the head, back, and coverts of the wings, are brown, edged with pale dull yellow; the breast and belly of the same colour, marked with a few long, narrow streaks of brown, pointing downwards; the thighs, legs, and toes, are covered with plain yellow feathers; the quill-feathers are dusky, barred with red; the tail is of a deep brown, adorned on each side; the shaft of the four middle feathers with a yellow circle, which contains a brown spot; the tip of the tail is white. The horns of this species are very small, and each consists of only a single feather; these it can raise or depress at pleasure, and in a dead bird they are with difficulty discovered. This bird is much more rare than the long-eared owl; both are solitary birds, avoiding inhabited places. These species may also be denominated long-winged owls; the wings, when censed, reaching beyond the tail; whereas in common kinds they fall short of it. The short-eared owl is a bird of passage, and has been observed to visit Lincolnshire in the beginning of October, and to retire early in the spring; so probably, as it performs its migrations like the woodcock, its summer retreat is Norway. During the day, it lies hidden in long old grass; when disturbed, it seldom flies far, but will alight, and sit looking at any person who happens to be present, at which time the horns may be seen very distinctly. It has not been observed to perch on trees, like other owls; it will fly in search of prey in cloudy and hazy weather. Farmers are fond of seeing these birds in their fields, as they soon clear them of mice. It is frequently found on the hill of Hoy in the Orkneys, where it flies and preys by day, like a hawk. This bird in Hudson's Bay is called the moule-bawk. It never flies, like other owls, in search of prey, but flies quietly on the slum of a tree, watching the appearance of mice. It breeds near the coast, making its nest with dry grays upon the ground, and migrates southwards in the autumn.

Mr. Latham gives a different description of this species, which is common in the northern and woody parts of Siberia; it frequently rushes blindly towards such fires as are light by night, and afflicts the persons near them. It is very fierce, and not at all wanting in courage, and will even attack the sportsman endeavouring to secure it. Mr. Latham says, that the ear-feathers or horns in reality composed of several feathers, and do not consist of one only on each side, as is commonly supposed; and their power of elevation is not very great.

Braulii; Brevi Owl. Body above pale rufous-brown, spotted with white, beneath whitish, with rufous-brown spots. It inhabits Brazil, and is about the size of a thrush. Bill, irides, short feet, and toes, yellowish.

Nasi; Mottled Owl. Body grey, beneath pale, both spotted with black and rufous; feathers of the head and breast dotted with black. It is found at New York, and is twelve inches long.

Indica; Indian Owl. Black-dusky; wing-coverts grey, wing black lines; breast buff, with small arrow-shaped spots. Inhabits Ceylon, and is seven inches long.

Zoreia; Sardinian Owl. Feathers of the ears eight or nine, bill greenish-yellow. It inhabits Sardinia and Italy; the toes are naked, seven inches long; it is solitary, does not migrate, and makes a howling noise.

Carniolica; Carniolick Owl. Body whitish-ash, with blackish spots and tranverse stripes. It inhabits Carniola, and makes its nest in hollow trees and rocks.

Demina; Yak Owl. Body red, of a small size. It inhabits the forests upon the Ural. It resembles the S. xubo in colour and form, but is much less; it weighs scarcely a pound; it builds its nest in fissures of rocks and hollow trees.

Pulchella; Siberian Owl. Body grey, variegated with brown, rufous, and white. It inhabits Siberia, and is nine inches long.

Scops; Little Horn-Owl. Ears of one feather each. This inhabits Europe; is seven inches and a quarter long, and preys on field-mice. In the dead body the ears are scarcely conspicuous; the colour varies according to the age, grey, rufous, brown or blackish; the legs are spotted with brown; the toes and claws are brown. This is a species
of uncommon elegance, and of a small size. The general disposition of its colours is similar to that of the eagle owl, but with a mixture of grey, which predominates on the breast and belly of the bird; it varies, however, considerably in the cast of its colours, according to the circumstances of age and sex; and when young it is said to be wholly grey: the irises are also said to be of a pale yellow in the young, and deep yellow or even hazel in the old birds; the legs are covered to the toes with speckled grey and brown plumage. The scope is a native of the warmer parts of Europe, and is of a migratory nature. In France it is said to arrive and depart at the same time with the swallow. At particular times great flights arrive, and wage war against field-mice, in those years when these animals happen to be unusually numerous. In Italy, its favourite residence is in gentry rising, wooded regions, but not among lofty mountains, and it lives chiefly on insects and earthworms. During the day it continues in the shade of the woods, perched on a branch, and remains motionless, with its ears or tufts erected; in this state it will permit a very near approach, and then only retires to hide itself afresh among the branches. Towards the dusk of the evening it emerges from its retreat, perches on a tree in some open spot, and begins its cry, which consists of a quick and often repeated whistle. It is a solitary bird, and is said to be as choosy in the selection of its eggs, to the number of five or six, in the hollows of trees. In Italy, the young are full-grown by the beginning of July, when they follow their parents during the night for food, till they are able to feed themselves, and to procure grasshoppers, beetles, and other insects. When this period commences, they leave their parents, and each lives separately. They remain in Italy till October, at which time they become very fat, and would be good food, but for a peculiar smell attaching to the flesh. When taken very young, they become by constant attention familiar, and to a certain degree affectionate, but this courtship only goes on so long as their dependence is necessary for their support. After that period is elapsed, their familiarity subsides, their confidence diminishes, and at length they make their escape, and seem to fly from mankind as the general tyrant of nature.

B. Earls.

Nyctea; Snowy Owl. Body white, with a few brown lunate spots. This is found in Europe, America, and Asia, and is often seen by day, especially near banks and lakes, on the herons, hares, mice, and sometimes carrion; makes a howling noise; in winter it is often snow-white. It has a variety of notes, the bill and claws are black. According to Mr. Pennant, this species varies greatly in weight, being from three pounds to a pound and a half. It inhabits the coldest parts of America, even as high as the remote mountains in the icy centre of Greenland, from which it is known to migrate to the shores. It adds horror even to that country, by its hideous cry, resembling the voice of a peron in deep distress. It is rare in the temperate parts of America, and rarely seen at all in the United States. It is very common in Hudson's Bay, Norway, and Lapland. It has no dread of the utmost rigour of the season, but bears the cold of the northern regions the whole year. It flies by day, and is scarcely distinguished from the snow; it falls perpendicularly on its prey; feeds on white grous, and probably on hares; hence its Swedish name barfjung. In Hudson's Bay it is almost domesticated, harbours in places near the tents of the Indians. It is scarce in Russia, but rather common on the Ukrainian mountains, and all over the north and east of Siberia, and in the Asiatic empire, even in the hot latitude of Astrakan. In Kamtchatka it is very numerous.

Tengmalmi; Swedish Owl. Body grey, with small round spots. It inhabits Sweden, and is the size of a blackbird.

* Nebulosa; Barred Owl. Head, neck, breast, back, and wing-coverts, brown, spotted with white; the belly and vent are of a dirty-white, streaked with brown; the tail is marked with brown and whitish bands, whitish at the tip. It inhabits Hudson's Bay and New York; sometimes, but rarely, in England. It is two feet long, and feeds on mice, hares, and cranes.

Ferspicillata; Spectacle Owl. Head white, smooth, downy; body above, area of the eyes, and chin, brownish; beneath reddish-white; the breast is barred with reddish-brown. It inhabits Cayenne, and is twenty-one inches long.

Cinerea; Sooty Owl. Head, neck, and wing-coverts, sooty, with dirty-white lines; breast and belly white, with large oblong dusky brown spots. It inhabits Hudson's Bay; is two feet long; flies in pairs, and preys on mice or hares. The bill is whitish; irises yellow; the tail is marked with oblique brown and dirty-white streaks; a part of the skin from the chin to the vent bare of feathers.

* Cucuma; Spotted Owl. Body brownish, back and tail-coverts white, spotted with dusky; breast and belly of a dirty-white, with reddish lines crossing each other. This is also found in Hudson's Bay: it is two feet long: forms its nest of moss on the ground, and preys on mice and small birds: its flesh is considered as excellent food.

Cunicularia; Coquinabro Owl. Body above brown, beneath white; legs warty and hairy. It is found in Chili; is the size of a pigeon; flies in pairs, sometimes by day; and preys on insects and reptiles; it lays four eggs, variegated with white and yellow, in long subterranean burrows. The irises are yellow; the body above spotted with white.

Aluco; Aluco Owl. Head rufous; irises black; first quill-feathers ferrate. This is found in divers parts of Europe; is about fifteen inches long; lives during summer in woods, in winter near habitations; it feeds on mice.

Sylvestris; Auffriarian Owl. Body variegated white and brown; the space round the eyes is white, the irides red. It inhabits Auffria; is of the size of a fowl; the covering of the head is an elegant radiant wreath of white feathers.

Alca; White Owl. Body above tawny, spotted with grey; beneath white, black and tail feathers rufous, the latter tipt with white. It inhabits Auffria, as does the next.

Noctua; Rufous Owl. Body pale rufous, with longitudinal brown spots; the irises are brown.

Rupa; Ferruginous Owl. Body rufous, spotted with brown; the irises are blueish. It inhabits the woods of Iridia.

Soloniensis; Solonefe Owl. Body above black-brown mixed with tawny, beneath white; tail white, with blackish lines crossing each other near the tip. This inhabits France, and is fifteen inches long. Crown, and outward circle of feathers round the face, variegated with reddish and white; toes horn-colour.

* Flamma; Common Owl. Body above pale yellow, with white dots, beneath whitish, with black dots. It inhabits Europe, America, and Northern Asia, and is about fourteen inches long.

Barbata; Mountain Owl. Space round the eyes and chin black. Bill and irises yellow; body cinereous; primary quill-feathers ferrate on both edges.

* Stridula; Tawny Owl. Body rufous, the third quill-feather
feather is longer. It inhabits Europe and Tertiary, and is nineteen ounces in weight.

* Ulula; Brown Owl. Body above brown, spotted with white; tail-feathers with linear white bands. A variety is much smaller, though some writers confine these two varieties as merely the male and female of the same. This species inhabits Europe and Newfoundland, and is about fourteen inches long. With respect to the general manner of the brown owl, or Ulula, as called by Pennant, the webbed owl, the naturalist observes, that by night these birds are very clamorous, and when they hoot, their throats are greatly inflamed. In the dusk they approach our dwellings, and will frequently enter pigeon-houses, and make great havoc in them. They destroy numbers of leverets, as appears by the legs frequently found in their holes; they also kill abundance of moles, and fink them with as much dexterity as a cook does a rabbit.

Arctica; Arctic Owl. Body rufous-brown, above spotted with black, beneath streaked with narrow brown lines; bill, orbits, and band under the wings, brown. It inhabits Sweden, and is eighteen inches long.

Funerea; Canada Owl. Body brown, with a few large white spots above, beneath white, with transverse narrow brown bars; the tail is long, with broad brown and narrow white bars. This species is found in many parts of Europe and North America. The head is black, with white points; five first inner quill-feathers not spotted on the outer edge; the irids are yellow.

Hudsonia; Hawk-Owl. Feathers above brown, with white edges, beneath white, with transverse black lines; the bill and irids are golden. This bird, says Edwards, who was the first discoverer of it, rather larger than a sparrow-hawk, and has much the air and manner of a hawk, from the length of its wings and tail; but the form of the head and feet clearly shew it to be near of kin to the owl kind. The birds of this species fly and prey at noon, which is contrary to the nature of most of the owl kind. The bill is like a hawk's, but without angles on the sides, of a bright reddish-yellow. Mr. Edwards was told that the eyes are of the same colour. The spaces round the eyes are white, a little shaded with brown, and dappled with small, longish, dusky spots; the outides of these spaces, towards the ears, are encompasshed with black; without that again is a little white; the bill is covered almost with light-coloured bristle feathers, as in most of the owl kind; the top of the head is of a very dark brown, spotted finely with little regular round spots of white; round the neck, and down to the middle of the back, is dark brown, the feathers seeming to be tint with white; the wings are of a brown colour, the quill and covert feathers being finely spotted on their outer webs with white; the three quills next the body are not spotted, but have whitish tips; the feathers between the back and wing are painted with broad transverse bars of brown and white; the inner coverts of the wing are white, with transverse lines of brown; the quills within are of a dark ash-colour, with white spots on both webs; the prime quill is spotless, and without on its outer web, and hardly any of that reflecting back of the point of the outer web, as is observed in owls; the rump and covert-feathers of the tail are dark-brown, transversely barred and mixed with a lighter brown; the tail on the upper side is dark brown, and ash-coloured beneath, composed of twelve feathers, the middlemost longer by two inches acros than the very outermost; it is barred acro by seven or eight transverse narrow bars of light brown; the breast, belly, thigh, and coverters under the tail, are white acros, with narrow brown lines in a regular manner; the legs and feet are wholly covered with fine soft feathers of the colour of the belly, but the variegating lines are smaller; the claws are sharp, crooked and pointed, and of a dark brown colour. There was, says Edwards, another of this species brought with this, which was a little bigger, and differed something in colour, which he imagines was the female of this. These were natives of Hudson's Bay, where its native name is Caprascacc. It preys on white partridges and other birds, and is so bold as to stand near the former with his gun, and will sometimes carry off a partridge after it is shot, before the sportsman can come up to it. Pennant, in his Arctic Zoology, says this species is common to North America, Denmark, and Sweden; it never hatches above two at a time, which for months after flight remain of a rufous-brown colour.

Uralensis; Ural Owl. Body whitish, with longitudinal brown spots in the middle of each feather. It inhabits the mountains of Ural, in Siberia, and is the size of a hen. The bill is of a wax colour; the irids and eye-rids are black; orbits ash; the rump is white; the tail is long and wedged.

Accipitrina; Caspian Owl. Body above yellowish, beneath yellowish-white, both sides with longitudinal blackish streaks, belly dotted with black, irids citron. This inhabits near the Caspian sea; and is the size of the brown owl. The bill is black; wings beneath and vent white; quill-feathers outside yellowish; within white testellate with black; the tail is rounded, shorter than the wings, blackish barred with white, and whitish at the sides.

Javanica. Body cinereous, in a few places reddish, with black and white spots; beneath it is of a dirty-white, mixed with reddish and black spots.

Nova Zealandia; New Zealand Owl. Irids yellow; body above brown, spotted with white; beneath it is tawny. There is a variety of which the body is brown, the feathers edged with tawny; the tail is brown, with paler bars; orbits tawny. It inhabits New Zealand: is eleven inches long; the bill is horned, with a black tip.

Cayennensis; Cayenne Owl. Body streaked with reddish, and transversely waved with brown; the irids are yellow. It inhabits Cayenne, and is the size of the fierce-owl. The bill is horned, claws black.

Dominicensis; St. Domingo Owl. Body beneath rufous; breast a little spotted. It inhabits St. Domingo; resembles the brown owl: bill larger, stronger, and more hooked.

Tolchiquati; New-Spain Owl. Irids pale-yellow; body above variegated with black, pale-yellow, white and tawny; beneath white. It inhabits New Spain. The bill, claws, and lower wing-coverts, black.

Chichicatl; Mexican Owl. Body tawny, variegated with brown and black; the eyes are black, the eye-rids blue. It inhabits New Spain, and is about the size of a ham.

Acadica; Acadia Owl. Body above bright bay, spotted with white; beneath dirty-white, mixed with rufous. It inhabits North America, and is seven inches long. The bill is brown, the irids yellow, crown with pale spots; orbits cinereous; toes brown.

Pasarina; Little Owl. Quill-feathers with five rows of white spots. There are two other varieties.

1. Smaller, eyes surrounded with white circles. 2. Larger; wings variegated with brown and yellow; the chin is white; the bird is twelve inches long. This species is found in many parts of Europe, but is rare in England. It appears to vary not only in the cast of its plumage, but in the colour of its irids, which, in some specimens, are said to be of a darker colour than those in which the irids are yellow. The passerine owl frequents ruins, and is said to deposit its eggs in such
such situations more frequently than in trees. It is a bird of a very wild disposition, and the young, when taken, even in the earliest stage, soon exhibit a ferocious character, and differ totally in temper and manners from those of the scoops, or little horned owl. 

*Larissus*: White-fronted Owl. Body rufus-brown, beneath paler; forehead white; quill-feathers barred with black and white. It inhabits North America, and is five inches long. The eye is bluish, tint with black; the tarsi are yellow; a semicircular white line behind the ears to the crown; lower part of the belly and legs cinereous; claws black.


**STROAKING**, a method of cure which some people have adopted in certain diseases, consisting in a mere application of the hand to the part affected, in the way of friction or rubbing.

*This* friction has very considerable uses in many diseases, is allowed. But as to the particular efficacy of the stroak of particular persons, we see little foundation for it in nature. Experience, indeed, seems to afford some, to which we do not well know what to object.

Mr. Thereby, in the Philosophical Transactions, No. 256, p. 332, or Abr. vol. iii. p. 11, gives several very remarkable instances of cures performed by that famous stroakker, Mr. Greatrix, and adds, that when Mr. Greatrix stroaks only for pains, he uses nothing but his hand; but that for ulcers, or running fowes, he uses spithe on his hand or fingers.

**STROBILES**, a word used by surgical writers to express a pledge of a twirled form.

**STROBILITAE VINUM.** See VINU.M.

**STROBILUS**, in *Botany* and *Vegetable Physiology*. *Strobilus*, or *Strobilus*, a name applied by the Greeks to the cone of a fir-tree, and adopted in the same sense by modern botanists, for every seed-veil of the same structure and character. (See PERICARP.) *A Strobilus*, or Cone, is a catkin, hardened and enlarged into a seed-veil, usually of a woody texture; sometimes rather coriaceous; rarely pulpy. In the most perfect examples of this sort of fruit, the seeds are closely shelled by the scales, as by a capsule, which, when dry, separate and spread, so as not to be brought together again, except by immersion in water. Thus the seeds, generally winged, are enabled to escape in the wind. Of the various species of Fir, Pimms, as well as the Cypress, and their allies, are examples. In the Birch and Alder, the Strobilus has a kind of capsule to the seeds, within the scales. The catkins of Poplars and Willows do not produce Strobilus, each of their scales being annexed to a flaked bivalve capsule, totally distinct therefrom. The *Platanus*, *Liquidambar*, and *Comptonia*, have globular catkins, in which bristles or tubercles supply the place of scales, and are far analogous to a real Strobilus. In *Juniperus*, the structure of whole fruit, in its origin, is exactly analogous to that of Pimms, what should be the scales of a Cone, become juicy instead of woody, and compose a soft homogeneous berry, in which the seeds are imbedded.

**STROBNITZ**, in *Geography*, a town of Bohemia, in the circle of Bechin; 4 miles S.S.W. of Gratz.

**STROBUS**, among the *Ancients*, a kind of mirror which bore to a height by many windings and turnings, and used by the Barbarians; instead of which the Romans wore the *apex*, which had a high but straight top.

**STROBUS**, in *Ancient Geography*, a town of Macedonia; which was a Roman colony.

**STROCAL**, in *Glyze-makings*, a long iron instrument like a fire-hoe, used to empty the metal out of a broken pot into a whole one.

**STROCHA**, in *Geography*, a town of the duchy of Stettin; 4 miles W. of Rottenman.

**STROEIA**, in *Geography*, a town of Denmark, in the island of Zealand; 6 miles S.W. of Fredericksburg.


Gen. Ch. Cal. Perianth inferior, of four ovate, acute, deciduous leaves; the two outer ones concave; inner flat. Cor. Petals four, laeacolate, all turned to one side, vawry, with claws the length of the calyx; sometimes wanting. Neurary of one leaf, ligulate, lanceolate, ascending, infected into the elongated receptacle towards its base; its tube slender, longer than the petals. Stam. Filaments five, sometimes but four, thread-shaped, unequal, infected into the stalk of the germen, two in the middle, three below, longer than the neurary; anthers oblong, erect. *Pyl*. Germen on a stalk exceeding the length of the germen, ascending, oblong; style none; stigma sessile, obtuse. *Peric.* Berry coriaceous, flaked, cylindrical, of one cell and two revolute valves. Seeds numerous, kidney-shaped, compressed, smooth, imbricated in three rows, imbedded in pulp. Eff. Ch. Petals four, or none. Neurary ligulate. Calyx of four leaves, deciduous. Berry coated, flaked.

1. *S. farinosa*. Mealy Stroemia. Vahl. Symb. v. 1. 50. Wildl. n. 1. (Cabad farinosa; Forlk. cent. v. 3. n. 12.)—Leaves oblong, mealy. Flowers with petals, and five flaments.—Native of Arabia. A shrub, with round branches, which, when young, are covered with a glaucous powder. *Leaves* alternate, on very short stalks, half an inch broad, entire, obtuse, without veins, flat, bejinkinkled, especially at the back, with a glaucous powder. *Stipulas* none. *Clavules* terminal, of six or eight *flowers*, drooping in the bud. *Petal* four, undulate. *Neurary* white, small; its limb revolute, narrower than the tube.—The Arabs call this plant *Afal*, *Korah*, or *Sarab*, and consider it as a counter-poison, with which intention they either chew the young and moist tender shoots; or eat them dried and pulverized.

2. *S. tetrandra*. Tetradromous Stroemia. Vahl. ibid. Wildl. n. 2. (Cleome fruticosa; Linn. Sp. Pl. 927. Burm. Ind. 1. 46. f. 3.)—Leaves elliptic-oblong, obtuse, with a small point, naked. Flowers with petals, and four flaments.—Native of the East Indies. *The stem* is shrubby, round, branching, leafy, smooth. *Leaves* nearly two inches long, flaked, green and smooth on both sides, with one rib, and many oblique veins. *Clavules* terminal, simple. *Flowers* near an inch in diameter; as far as can be judged from a dried specimen, they appear of a pale red, or yellowish. The *germen* are infected far up the stalk of the germen, but still much below the latter, so that this flower is by no means gynandrous.

3. *S. glandulosa*. Glandular Stroemia. Vahl. ibid. Wildl. n. 3. (Cabad glandulosa; Forlk. cent. v. 3. n. 13.)—Hair and viscid. Leaves roundish. Flowers without petals.—Native of Arabia, where it is called *Tamanin*. The *stem* is shrubby, with round branches, clothed, like the whole plant, with glandular hairs. *Leaves* rough, entire, pointed, brittle, half an inch broad. *Clavules* terminal, from four to five drooping flowers. *Fruit* rough with club-shaped bristles.

4. *S. rotundifolia*. Round-leaved Stroemia. Vahl. ibid. Wildl. n. 4. (Cabad rotundifolia; Forlk. cent. v. 3. n. 11.)—Leaves
STR

- Leaves orbicular, smooth. Flowers without petals.-

Frequent about Lobelia, in Arabia, and known by the name of _Kudahb_. This is a large tree, with thick, round, smooth, often emarginate, leaves, an inch broad, on round footstalks, which are half an inch long. _Clusters_ terminal, of eight or ten erect flowers, defoliate of petals, but furnished with an ovate, broad, flat _nectary_, tawny above, yellow beneath, green and slender at the base. _Stamens_ inserted near the bottom of the stalk of the _germen_. _Fruit_ two inches long, hanging by a stalk half that length, cylindrical, smooth, green, uneven, the thickness of a goose-quill; the valves, when they expand, are red on the inside. _Seeds_ black, in a red dry pulp.

STROEMSHOLM, in Geography, a town of Sweden, in Westmanland, on the Malart lake; 54 miles S.W. of Upsal. N. lat. 59° 30'. E. long. 16° 14'.

STROGELAVACCA, a town of Italy, in Friuli; 8 miles N. of Concordia.

STROKE, in Sea Language, a single sweep of the oars in rowing. Hence they say, _row a long stroke_, which is intended to push the vessel forward the more readily.

STROKESMAN is the person who rows the hindmost oar in a boat, and gives the stroke which the rite are to follow; so that all the oars may operate together.

STROLL, in Agriculture, a term provisionally applied to a narrow flake of land.

STROM, in Geography, a town of Norway; 14 miles S.S.W. of Bergen.—Ales, a town of Sweden, in Jamtland; 47 miles N.E. of Östersund.

STROMA, Island of, is situated in the Pentland Firth, about a league from the shore of Caithness, and county of Caithness, Scotland. It is a low islet, of a mile in length, and half a mile in breadth, and usually contains about thirty families. It is very productive in corn; but the principal employment of the inhabitants is connected with the sea. Fuel in this, as in most of the other Scottish islands, is difficult to be procured, whence the islanders are obliged to supply themselves with moss from the mainland. Here is a school, and the inhabitants regularly cross the Sound to the church. On the west of Strom a is a vast cavern, at about thirty yards from the beach, stretching down to a level with the ocean, the waves of which pour into it by a narrow opening. In stormy weather, the spray of the waves is tossed above the summits of the western rocks in such torrents, as to run in rills to a reoverflow on the opposite shore; and this, with the addition of the rain-water, is sufficient to keep a grain-mill in motion during the winter. From the influence of the salt particles continually floating in the air of Strom, the dead bodies of the sealers were preferred from putridity for many years, and some of them were exhibited in a chapel, as antiquities. The claim to the island of Strom was once contended by the earls of Orkney and Caithness, and decided in favour of the latter, because venomous animals were found to live here and die in the Orkneys. The name of Strom or Storma, is significative of the impetuous currents that prevail around the islet.—Carlile's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, 8vo, vol. iv.

STROMATEUS, in Ichthyology, a genus of fishes of the order Apodes: the generic character is as follows. Head compressed; teeth both in the jaws and palate; body oval, broad, slippery; tail forked. There are three species.

FIATOLA. Body beautifully barred. It inhabits the Mediterranean, and has two romachs.

FARU. The back is of a gold-colour; the belly is silvery.

This is chiefly found in South America and Transvaal; it feeds on lesser fish and oysters; the body is slender, covered with small thin deciduous scales; the flesh is white, tender, and reckoned very delicious food. Its other and minor characters are, that it has a middle-fixed head, flopping, above brownish; the eyes are large and the pupil black; the iris is marked with a white ring and another yellow one; the mouth is small; the jaws equal; teeth small and sharp; lips strong and movable; tongue smooth, broad; aperture of the gills very large, the cover of one piece, and surrounded with a membrane; the lateral line nearer the back, broad, silvery; vent nearer the mouth than the tail; the fins are long, scaly, rigid, white at the base, and edged with blue; the rays are soft and branched.

CUMARA. Back blue; belly white. It is found in the fresh waters of Chili; is about a span long, and not crooked with stripes.

Besides the above species enumerated by Gmelin, Dr. Shaw mentions the following.

CINNARUS, or ash-coloured Stromateus with a forked tail; the lower lobe longer than the upper. The body of this species is of a more rhomboid form than that of the others, and the fins are somewhat more extended or pointed: the tail is more deeply forked, the lower lobe considerably exceeds the upper in length; the colour of the whole animal is cicereous, with a cast of yellow on the sides of the head and the base of the fins and tail; the pectoral fins are tinged with red. It is a native of the Indian seas, and grows to about the length of a foot or more, and is about two inches in thickness; it is considered as excellent food, but the largest specimens are the finest flavoured. The bones are said to be of a soft or nearly cartilaginous nature; the residents in India use this fish both in its fresh and salted state, prepared in various ways. The trivial name with them is Pamperl.

ARGENTEUS; Silvery Stromateus. The lobes of the tail of this species are equal. It is of the same general form with the preceding, but with rather shorter fins and tail; the lobes of the latter being both of equal length; the mouth is situated considerably beneath the muzzle, which is thick and round; the colour of the whole animal is bright silver, with a blueish or dullish tinge on the back and fins; the scales are small, thin, and easily deciduous. It is a native of the same seas with the preceding, and is in equal estimation as an article of food.

NIGER; or Black Stromateus. This species is entirely black. It is, however, very nearly allied to the former in shape, but the mouth is placed in the usual manner, the upper part of the muzzle not rising above it, as in that species; the colour of the whole animal is blackish, with a silvery cast about the back and sides of the head; the scales are small, and the lateral line, as in others of the genus, is curved in the direction of the back. It is a native of the Indian seas, and not regarded in much estimation as an article of food, on account of a popular prejudice entertained against it from its colour, as well as from its feeding on onicci (see Oniscus), which are occasionally found in its mouth.

Dr. Shaw observes, that there is a considerable degree of general resemblance between the habits of the genus Stromateus and that of chondrodon; but as the species of the Stromateus are defilute of ventral fins, they cannot be placed in the same artificial order, and must rank among the apodes. "The same is the case with some other genera which are naturally allied to fishes placed in very different orders. This forms the greatest objection to the Linnean arrangement of fishes; it would, however, be difficult to prove that a more natural
natural distribution would lead to a reader investigation of the animals."

STROMBERG, in Geography, a town of Germany, in the bisbopric of Munster; 20 miles S.E. of Munster. N. lat. 51° 45'. E. long. 8° 15'.—Allo, a town of France, in the department of the Rhone and Mofelle, and chief place of a canton, in the district of Simmer. The place contains 6644, and the canton 70431 inhabitants, in 25 communes; 26 miles W. of Mentz. N. lat. 40° 55'. E. long. 7° 40'.

STROMBOLI, one of the Lipari islands, or the first of the Eolian isles to the north-east. It was called Strongylus (Strongylus) by the ancient Greeks, from its round figure; and was celebrated for its extraordinary volcano, the eruptions of which admit only of short, but periodical intermissions. This island is distant from Sicily 50 miles, and its fires are discoverable at the distance of at least 100 miles. From the quantity and colour of the smoke, and the magnitude of the explosion of the volcano, the people of the country are enabled to foretell the winds which will be propitious or adverse to mariners. Eolus, who is said to have reigned in the Lipari or Eolian isles, is fabulously denominated the king of the winds, probably, as some writers have conjectured, because, from the changes in the smoke and eruptions of the volcano, he was able to predict what winds would blow. (See Eolus and Lipari.) Spallanzani, who had an opportunity of making observations on this volcano, is said to have been much inclined to receive implicitly all that the people of Stromboli do positively assert concerning it, more especially as the mariners of the other Eolian isles are of a different opinion. Accordingly it is a prevalent expression among the mariners of Felicuda, "Stromboli non fa marinaro," i.e. Stromboli will not make a feaman. The whole shore of Stromboli, to the east and north-east, examined by Spallanzani, is composed of a black volcanic sand, which, according to M. Dolomieu, is an aggregate of fragments of shoers; and with these shoers, which are entirely perfect, and exist as such in the form of detached magnets, Spallanzani discovered with a lens a number of small transparent and vitreous bodies, of a yellowish-green tincture, insensible to the magnet. This sand extends into the sea, to the distance of more than a mile from the shore, and probably to a greater distance. This sand easily penetrates through it; for by digging in any part of the shore to a little depth, sea-water is found, somewhat thickened by passing through the sand. This sand dries up that part of the island which fronts the east and north-east, extending on one side to the sea, into which it stretches, and on the other to the summit of the mountain; and it owes its origin partly to the immediate ejections of it by the volcano, and partly to the pieces of scoriaceous lava thrown out by it, which being very friable, and abounding in shoers, is easily decomposed, and becomes pulverized in this sandy matter. The sand is found principally near the volcano; but as it is easily moveable, it is carried by the wind to the valleys and lower grounds, quite to the sea. Under this covering lies the firm texture of the island, that is, the solid lavas, which are visible on several steep declivities, that have been stripped of the sand, either by the action of the rain-water, or of that of the winds. The surface of the island is about nine miles in circumference.

The crater of this island is suppos'd to have been anciently situated on the summit of the mountain, and the lavas which had contributed to its formation had flowed from that crater. Stromboli differs from Etna and Vesuvius, on the sides of which are mountains of an inferior size, owing their origin to fire, by being entirely a single mountain, except that its top is divided into two summits.

Hence it appears that there have been none of those eruptions in its sides, which generate leffer mountains, or hills, of a conical form. From various testimonies collected by Spallanzani, he concludes that the volcano of Stromboli has burned for more than a century where it now burns, without any sensible change in its situation. The highest of the two summits of Stromboli, which inclined to the south-west, at the other does to the north-east, was estimated to be elevated about a mile above the sea. These summits have no crater, nor any vestiges of such; but these vestiges are sufficiently evident on the sides of the plain that separates them, which here sinks into a cavity, about 300 feet in length from east to west, above 200 in breadth, and 160 in depth. Spallanzani is of opinion that this was the first and largest volcano of Stromboli, which formed the contexture of the island by its lavas, and which, in a great degree, had been filled up and destroyed by the earthy depositions of the rain-waters, the matter ejected into it by the present volcano, and, perhaps, by the falling in of its own sides. Hence he conjectures that the principal volcano had formerly existed on the summit. The edges of the crater, which is of a circular form, and not more than 340 feet in circumference, are composed of a confused mixture of lavas, scoriæ, and sand. The internal sides contract as they descend, and assume the shape of a truncated inverted cone. The crater, to a certain height, is filled with a liquid red-hot matter, resembling melted brass, and which is the fluid lava. This lava appears to be divided into two portions: one, which is, in the interior, whirling, and tumultuous; and the other, that by which it is impelled upwards. When this liquid matter is raised within the crater, and reaches the distance of 25 or 30 feet from the upper edge, a sound is heard like that of a very short clap of thunder; while, at the same moment, a portion of the lava, separated into a thousand pieces, is thrown up with great rapidity, and is accompanied with a copious eruption of smoke, ashes, and sand. A few moments before the report, the surface of the lava is distilled, and covered with large bubbles, some of which are several feet in diameter; and at the same instant, the detonation and fiery shower take place. After the explosion, the lava within the crater sinks, but soon again rises as before; and new tumours appear, which again burst, and produce new explosions. When the lava sinks, it produces little or no sound; but when it rises, and especially when it begins to be inflated with bubbles, it is accompanied with a sound, similar, in proportion to the difference of magnitude, to that of a liquor boiling vehemently in a caldron. When the lava is at its height, the depth of the crater may be about 25 or 30 feet; and when it has subside, about 40 or 50; and, therefore, the greatest rise of the lava may be estimated at about 20 feet.

The component substances of this island are scoriæ, lavas, tufas, pumices, and specular iron. Two species of the scoriæ are of the nature of porphyry; as they are composed of a horn-stone, in which felspar and shoers are incorporated. The third species of scoria belongs to the ancient volcano, and is found, on removing the sand, at a small depth, on the east side of the island, a little above the foot of the mountain; diffused in strata forming one body with the adjacent lavas, which, at some remote period, flowed from the summit of Stromboli into the sea. In this were discovered black shoers and white felspars; the body of its substance not differing from that of the other two kinds. Our author has particularly described the other substances above enumerated. Upon the whole he observes, that this island may be said to be formed, as far at least as externally appears, of scoriæ and lavas; and that the material origin of
and increase of Stromboli is to be attributed to porphyry, which, melted by subterraneous conflagrations, and rarefied by elastic gaseous substances, rose from the bottom of the sea, and, extending itself on the sides, in lavas and scoriæ, has formed an island of its present size.

From the authorities of various writers it appears, that the most ancient accounts of the conflagrations of Stromboli, transmitted to us by history, are prior to the Christian era by about 250 years, the date of the reign of Agathocles, the celebrated tyrant of Syracuse. This volcano burned unceasingly, in the time of Augustus and Tiberius, when Dionysius and Strabo flourished. But after this latter period, a long series of ages succeeds, during which, from want of documents, we are ignorant of the state of Stromboli; and it is not until the 17th century that we again know, with certainty, that it ejected fire; though it is not improbable that it continued to burn likewise during the times in which we find no mention of it in history; on which supposition, its uninterrupted conflagration, for so great a length of time, must indeed appear astonishing. Yet, though it should have ceased for several ages, we know, from various public testimonies, that its continued eruptions cannot have lasted less than 200 years.

That Stromboli contains within its deep gulfs and recesses an immense mine of burning sulphur, we can entertain little doubt, when we consider the streams of smoke, of extraordinary whiteness, a colour which constantly accompanies sulphureous fumes, that rise on the west side of the island, and the smell of sulphur, not only perceptible from them, but from the large cloud of smoke which overhangs the summit of the mountain. The small pieces of that mineral, procured near the apertures whence those fumes arise, are likewise another proof.

Sulphur alone may be sufficient for the nourishment of the volcano, when its flame is animated by oxygenous gas, the presence of which, in volcanic abysses, seems undeniable, from the substances they contain proper to generate it, when acted on by the fire. The long duration, without intermission, therefore, of these conflagrations, may be very sufficiently explained by the immense quantities of sulphur, or, to speak more properly, sulphures of iron which we must necessarily suppose contained in the bowels of the mountain. It is rendered the more probable by the prodigious subterraneous accumulations of this mineral, which have been discovered in various parts of the globe.

Although Stromboli and Lipari (which see) lie nearly under the same degree of latitude, or 38° N., the former is much hotter in summer than the latter, especially near the sea, on account of the strong reflection of the rays of the sun from the large tracts of sand. The winter here is always mild; it never freezes; and snow, which is seldom seen, if it falls one day, melts the next. The sea round the island is frequently agitated by storms to such a degree, that the billows sometimes rise to one-half the height of a rock, on the north-east side of the island, called the rock of Stromboli, 300 feet in height. The shore of Stromboli has neither port nor harbour; and veselis, in case of heavy storms, can only seek some refuge on the back of the island. The vessels employed by the natives are feluccas, which, being extremely light, are easily drawn upon land, and as easily launched again into the sea. Fish here are plentiful and large, particularly the sea-eels and murenas; the fishery, however, produces no branch of commerce, and only serves to supply the island, principally the foreigners who visit it; as the natives usually live on salt meat. Malafey is the greatest article of traffic of the people of Stromboli; they convey it in barrels to Lipari, where they find a ready sale for it. The vines producing the paffolo and paffolina grape, which yield this wine, grow on the sea-shore, forming a chain to the north-east, and are all planted in volcanic sand. The habitations of the islanders are built in the same part, and under the same aspect. They are irregular assemblage of cottages and fishermen's huts. The population of the island amounts to about 1000 persons, and has been for some time increasing; in consequence of which, exertions have been made to enlarge the cultivable ground, by clearing away the weeds. The character of these islanders, by some misrepresented as savages, is nearly the same with that of the inhabitants of other villages at a distance from, and having no communication with, populous cities: they are simple, honest, and, having few ideas, are contented with the little they possess. Here are no stationary birds, though attempts have been frequently made for naturalizing partridges. Rabbits multiply, huskishing, in their natural wild state, in the wooden part of the island: the musket and the ferret are their only enemies. The birds of passage are as at Lipari. Spallanzani's Travels, vol. ii. and iv.

STROMBUS, in Natural History, a genus of the class and order Vermes Teflace. The generic character is, Animal a limax; shell univalve, spiral; aperture much dilated; the lip expanding, and produced into a groove, leaning to the left. These shells in their younger state want the lip, and have a thin turbinate appearance; many of them therefore, for this reason, have been mistaken by authors, and referred to a genus to which they do not belong. There are about forty-five species, divided into separate sections, according as the species have lips projecting, lobed, dilated, or tapering.

Species.

A. Lip projecting into linear Divisjons or Claws.

FUSUS. Shell tapering, smooth, with a tubulate beak and toothed lip. It is found in the Red sea; resembles a murex, in having the beak rather straight; nevertheless it approaches nearer the genus Strombus, in being smooth, and having the lip toothed; the shell is brown, and transversely striate at the base; the pillar is white; the beak is black outwardly.

* Paa PELLECANI; Corvornat's Foot. Lip with four plicate angular claws; the mouth is smooth. It is found in the American and European seas; is about two inches long; the shell is pointed; in colour it is whitish, cinereous, or reddish; within it is white, smooth, and polished; the whorls are tuberculate.

CHIRAGRA. Lip with fix curved claws, and recurved beak. It inhabits the Indian ocean, and is very rare and valuable. The shell is large, brown varieed with white; the back tuberculate; lip striate; it has fix claws, including the beak, which are long; the two hind-ones are divergent and bent outwards.

SCORPIS. Lip with four knotty claws, the hinder one is very long. It inhabits the Indian ocean, and is four inches long.

LAMBI. Lip with about seven straightish claws, and a smooth mouth. There are four varieties of it. It is found chiefly in Asia. The shell is large, brown varied with white; the mouth is reddish; claws not knotty.

MILLERPEPA. Lip with ten infected claws, and subfriate mouth; the back is compressed and gibbous. It inhabits the southern coasts of Asia.

CLAVUS. The shell of this species is tapering, smooth, with a tubulate beak and a simple lip.

B. Lobed.
STROMBUS.

B. Lobed.

LENTIGINOSUS. Lip thickened, and three-lobed on the fore-part; the back is warty, and crowned with tubercles; the beak is obtuse. It is about three or four inches long; and is found in Asia and America.

FASCATUS. Lip entire; the back is crowned with three rows of protuberances, and rosy between them. It is found in divers parts of Africa.

RAMUSUS. Lip thin, rugged, repand above; back orange, transversely striate, and crowned with tubercles; the aperture is polished and white.

GALLUS. Lip mucronate on the fore-part, and very long; the back is crowned with tubercles; the beak is straight. It inhabits Asia and America. It is about six inches long. The shell is sometimes uniformly brown, yellow, or violet; sometimes it is varied with spots and rays; the back is surmounted with smooth ribs, which are sometimes simple, sometimes double; the first whorl is crowned with tubercles, which in the other whorls are more or less conspicuous.

AURUS DIANA. Lip projecting to a sharp point; the back is muricate; the beak erect and acute. It inhabits the southern coasts of Asia, and is three inches long. The shell is thick, and generally variegated with colours.

PUGILUS. Anterior lip prominent, rounded, smooth; the spire is pinnate; beak three-lobed, obtuse. It inhabits South America.

ALATUS. Anterior lip rounded, prominent, smooth; spire unarmed; beak three-lobed, obtuse. It inhabits South America.

MARGINALUS. Lip a little prominent; the back margined, smooth; beak entire.

LUNATUS. Lip a little prominent; back smooth; whorls rounded and equal. This species is found on the southern coasts of Asia, and is about two inches and a half long.

GIGERUS. Lip a little prominent; back smooth; whorls gibbosus, unequal. It is found on the southern shores of Asia. The shell is white, with numerous bands, spots, and clouds; the lip is striate within, and with the pillar it is partly blue and partly red.

ONTUS. Shell ovate, with knotty belts, and a subulate smooth projection. This species is found in the South American ocean; and is about an inch long.

C. Dilated.

LUCIFER. Lip rounded, and entire on the fore-part; the belly is doubly striate; spire crowned with tubercles; the upper one minute. It inhabits South America. The shell is variegated, resembling the next; but is thinner, and armed with much less spines, and thought to be a younger species of G. gigas.

GIGAS. Lip rounded, and very large; the shell is crowned; the belly and spire have conic expanded spines. It is found in divers parts of South America; and is ten inches long and nine broad. The shell is of a beautiful glossy white; within it is of a rich rose-colour.

LATISSimus. Lip rounded, and very large; the belly is unarmed; the spire a little knotty. It inhabits Asia. The shell is solid, fourteen inches long, varietied with brown and white, sometimes radiate; the lip within is white; the mouth rosy.

EPIDERMIS. Lip rounded, short; belly smooth; spire a little knotty. It inhabits southern Asia; and is about three inches long.

MINUS. Lip retuse, gibbous; belly and spire knotty, with knotty plates; aperture two-lipped, smooth. Inhabits Inde; and is about an inch and a half long.

CANARIUM. Shell somewhat heart-shaped, with a rounded, retuse; smooth lip; pillars smooth. It inhabits the southern coasts of Asia.

VITATUS. Lip rounded, short; belly smooth; spire elongated; the whorls are divided by an elevated future. It inhabits Asia; and is about four inches long. The shell is white, with brown bands.

SUCCINCTUS. Lip rounded, retuse; belly smooth, with four, pale, linear, punctured belts. It inhabits different parts of Asia.

SPINOUS. Lip tapering, entire, slightly plaited, and crowned with fine spines; the spire is prickly. It has been found in the only in a fossile state, and very much resembles the Voluta vespertilio, but is not emarginate at the base; and the pillar is not always plaited; the shell is white, with numerous parallel lines, above angular, and crowned with very sharp spines.

FIRENA. Lip continued into a longitudinal cleft ridge. It inhabits India, and is found frequently in a fossile state in Campania.

URCEUS. Lip tapering, short, striate; the belly and spire have knotty plait; aperture two-lipped, unarmed. There are several varieties of this species. It is chiefly found in the Indian ocean, is two inches and a half long; and varies much in colours and marks.

TRIDENTATUS. The shell of this species is thin, white, with orange spots and clouds; the back is smooth and plaited; the beak is violet; the whorls are grooved; the lip is three-toothed. It inhabits the Indian ocean.

DENTATUS. Lip tapering, short, toothed; belly and spire plaited. This is very like the S. urceus.

OSTATUS. Lip very thick, first whorl crowned with tubercles, the interlacement of the tubercles plaited; the next transversely ribbed, the rest transversely striate.

BRONIA. Shell conic, with a mucronate eight-toothed lip and knotty spire. It is about seven inches long; extremely rare. Shell brown, varied with white and blueish clouds. Some authors suspect it is not of this division.

AFFINIUS. Shell transversely striate, gibbous; spire unarmed; the first whorl crowded with tubercles.

LATUS. The lip of this species is a little prominent, and twice emarginate beneath; the first whorl of the spire is smooth in the middle, and transversely striate on each side; the others are crowded with obtuse knobs.

LEVIUS. Shell smooth, silvery, radiate with brown, with obsolete, transverse plaits; the spire is elongated, with inflated rounded whorls.

VEXILLUM. Shell solid and subcylindrical, with alternate, red, and ochraceous bands; lip denticulate within; pillar flat, glabrous, and emarginate at the base. It is found in the Indian ocean, and is extremely rare.

NORWEGICUS. Shell oblong, subulate, white, with round whorls; aperture spreading, ovate; beak ascending a little. This is obtained on the coasts of Norway.

D. Tapering, with a very long Spire.

TUBERCULATUS. Shell ovate, oblong, tuberculate; lip thickened. It inhabits the Mediterranean. The shell is coars; the whorls covered with rows of raised horny dents; lip gibbous; aperture ovate; the beak is very short and recurved.

PALUSTRIUS. Shell smoothish; lip separated behind. It inhabits the Savannah near the Indian ocean. The shell is thick, and yellow or brown, with from twelve to sixteen whorls; the first twice as large as the next; the rest longitudinally plaited, and with from three to five transverse fringes.
STR

AER. Shell smooth, lip separated before and behind. It is found in the seas of Amboyna, and is more than two feet long. It is of a black-brown or bay, within white, very finely striate transversely; aperture ovate; spire subulate, with twelve flattish contiguous whorls.

LINAOTUS. Shell subulate, brown, with seven spiral impressed lines; the aperture is ovate.

PUNCTATUS. Shell subulate, yellowish-white, band striate with red near the future; the lefthand whorls grooved.

VIBEX. Shell subulate, cinerous, transversely striate; whorls nodulous, and marked with red streaks. It inhabits Coromandel; and a variety is found in the Friendly Islands.

VIGURUS. Shell scarred with brown; whorls muricate; aperture ovate. It is found in different parts of Africa; is an inch and a half long.

ACULATUS. Shell brown, tuberculate; whorls minute; lip depressed, crenulate. A variety of this species is named the Hercules club. This species inhabits the maraths of Africa, and is nearly two inches long.

AGONATUS. Shell smooth; the lip very prominent, and margined behind.

DELAOTUS. Shell with transversely striate, black whorls; the outer ones smooth, and with the margin of the lip and the pillar white.

FUSCUS. The shell of this species is brown, with numerous tubercles on the whorls; the lip is separated before and behind, within it is striate with brown.

MARGINATUS. Shell brown; the lowest whorl is edged with white.

LIVIDUS. Shell subangular, with spinous knots; the lip is separated on the fore-part.

STRIOATUS. Shell convex, striate, white, with a few fulvous streaks; the pillar is flattened and inflected.

SUBUTUS. Whorls turned contrary; the shell is thin, and longitudinally striate. It has hitherto been found only in a fossil state in Switzerland.

STROMENTO, Ital. in Myke, an instrument, plu.

STROMENTI, instruments, certain machines contrived to produce musical tones and intervals, in imitation of the scale or gamut used by the human voice. As the organ is the most noble and comprehensive of all musical instruments, its name from the Greek, Oganum, implying only an instrument, it is now underfooted to be the instrumentum, par excellénce; and all music performed on instruments is termed organical. For the three different kinds of instruments of which the tones are produced by wind, string, and percussion, see Instrument.

STROMLINGUS, in Ichthyology, a name given by some writers to the aras of the Greeks, which is no other than the common herring. There is no other difference between the Stromling and herring, but that the former is smaller.

STROMNESS, in Geography, a small town in the island of Pomona, and bailiwick of Orkney and Shetland, Scotland, situated in the south-west part of the Mainland, possessing an excellent harbour. At the commencement of the last century this place was small, and much confined in its commerce, in consequence of an arbitrary assize by the neighbouring royal borough of Kirkwall. This was at last removed by a decree from the supreme court, and the subsequential confirmation of the houfe of lords. After that period, Stromnesses began to increase in size and importance, and is now a place of considerable trade and extent. The population return of 1811, computed the inhabitants of Stromness parish to be 2557, and the houses 424. The inhabitants are tradesmen, shopkeepers, pilots, or shipmasters, and small proprietors of land. Here are a post-office and grammar-school, with a flax-mill, tannery, and breweries; a market for cattle is also held here. The old church of Stromnesses being ruinous and dilapidated, a new one was erected in 1717; but is not now sufficiently spacious: the house built by the Rev. George Graham, the laft bishop of Orkney, is yet standing, with the episcopal arms and date of its erection, 1633, cut in stone above the door. Several tumuli, or barrows, are remaining in this district; and here is a flate-quarry, with appearances of lead and iron ore.—Carlisle's Topographical Dictionary of Scotland, vol. ii. Beauties of Scotland, vol. v.

STROMNESS, a cape on the S. coast of North Ronaldshay, one of the Orkney islands.

STROMOE, one of the Faroer islands, in the Northerna ocean, and the largest; being about 30 miles in length, and 10 in breadth. N. lat. 62° 10'. W. long. 7°.

STROMSOE, a town of Norway, in the province of Aggerhus; 18 miles S.W. of Christiania. N. lat. 59° 44'. E. long. 10° 16'.—Alfo, a small island in the North sea, near the coaft of Lapland. N. lat. 69° 14'.

STROMSTADT, a town of Sweden, in Weft Gothland, on the coaft of the North sea, celebrated for its shellfish; 43 miles N.N.W. of Uddevalla. N. lat. 58° 59'. E. long. 11° 49'.

STRONDEBACH, a river of the duchy of Berg, which runs into the Rhine at Mulheim.

STRONG, a river of Bavaria, which runs into the Sempt, 2 miles E. of Mopurg.

STRONG, a township of America, in the district of Maine and county of Somerhill, situated on the Kennebeck, and containing 424 inhabitants.

STRONG Land, in Agriculture, a term sometimes applied to heavy, thick, tenacious sorts, which are not easily managed when in the tillage state. Some think that strong or heavy lands should always be followed when intended for wheat-crop, as those of the light kind are, when for turnips and barley. Others are of opinion that this kind of land constantly requires to have this sort of tillage for all these different crops, and that the less the light are touched by the plough the better, provided they are kept clean and free from weedy matters, and in good heart.

Strong lands of the clayey sorts are likewise thought by many, not to be capable of being easily kept in order and ameliorated by crops of the green kind, as the feeding them off on the ground poaches and temperers them to such a mortal state, as renders them fitter for the brick-maker, than the growing of corn. But that, when brought into this condition by such crops and too much treading, the clean fallow proceeds is the best and most ready means of restoring them. However, those who are so friendly to the expensive, wafeful, and dissipating practice of the fallow system on these kinds of strong land, should recollect that such a situation can only occur where such lands are very wet in their nature; and that by proper sorts of such crops, draining, and feating upon the proper times and seasons for managing them, every sort of difficulty and inconvenience will be at an end, and such objections to managing them in other ways be of little or no avail. See FALLOWING.

STRONG Place and Pulp. See the subfiantives.

STRONGBOW INDIANS, in Geography, Indians of North America, inhabiting the country about N. lat. 62°. W. long. 124°.

STRONGDEN, a town of Norway, in the province of Drothaim; 42 miles S.S.E. of Drothaim.

STRONGILO, a small island in the Grecian Archipe-
STR

lago: 6 miles S.W. of Paros. N. lat. 37°. E. long. 25° 10'.

STRONGNAS. See Strongnas.

STRONGOLI, a town of Naples, in Calabria Cirta, the see of a bishop suffragan of St. Severina; containing four churches. This was anciently a city of the Brutii, called "Petilia," and said to have been built by Philoctetes, after his return from the Trojan war; 16 miles S.E. of Caria Vecchia. N. lat. 39° 15'. E. long. 17° 15'.

STRONGYLE, in Ancient Geography, one of the Æolian islands. See Stromboli. Also, a name given by Pliny to the island of Naxos. Also, an island of the sea of Delos. 

Also, a town of Spain, on the coast of Beticia.

STRONGYLE, in Geography, a mountain on the N. side of the island of Candia; 8 miles W. of Candia.

STRONYLUS, in Natural History, a genus of the clafs and order Vernes Intelles. The generic character is as follows: Body round, long, pellucid, glabrous; the fore-part is globular, truncate, with a circular aperture fringed at the margin; the hind-part of the female entire and pointed; in the male, it is dilated into loofe, dilatant, pellucid membranes. There are only two Species.

Equinus. Head opaque; the intelline is black. It is found in the stomach of the horse, in great numbers. The male worm is of a pale yellow, with a fine yellowish membrane covering the intellines; the tail is three-leafed, with a small spine or two; the female with white siliform vehicles surrounding the intellines.

Oviform. This, as its name imports, is found in the intellines of sheep.

STRONSAY ISLE, in Geography, one of the Orkney islands in the North sea, and near the northern coast of Scotland, constitutes part of the shire of Orkney and Shetland, and, with the smaller island of Papa-stronfay, forms one parish. At some distant period, it appears to have been divided into three parishes, and remains of four chapels are said to be full standing in different parts of the island. The resident population of Stronfay in 1811, inclusive of the above-mentioned smaller island, was 804, which reduced in 175 houses. The rocks of this place are sandstone, the soil is very productive; in the eastern part are three chalky, earthy strata, which, though rising together, differ in their strength. The inhabitants of Stronfay place much confidence in the medicinal powers of the waters, and in the sea-weed denominated duft. The island abounds with flocks of golden plovers, and other sea-fowl; whilst the rocky coves are much frequented by seals. The principal employment of the inhabitants is the manufacture of kelp-felt from sea-weed, of which it is estimated that nearly 300 tons are made annually.—Carile's Topographical Dictionary, vol. ii. Beauties of Scotland, vol. i.

STRONTIAN, or STRONTIANITE, in Mineralogy, Strontianite carbonates of Hali, a mineral composed of a peculiar earth combined with carbonic acid, so called from Strontian, in Argyleshire, where it was originally found in veins along with galena, heavy spar, and calcareous spar, in a rock of granite. Its colour is generally pale green and greenish-white, sometimes inclining to yellowish-white. It occurs massive and crystallized. The crystals are acicular, fixed or filled in, terminated by low fixed pyramids. The crystals are aggregated in diverging groups. The massive strontianite has a shining, pearly lustre, and a fibrous and radiated structure. The cross-fracture is fine-grained and uneven, and presents a glistering fracture. It is sometimes formless, transparent, and always more or less transparent. It yields easily to the knife, and is brittle. The specific gravity of strontian is 3.675; Klaproth.

Strontian is fusible by the blow-pipe, but becomes white and opaque, and tinged the flame of a dark purplish-red. It is soluble with effervescence in nitric or perchloric acid, and paper dipped in the solution burns with a purple flame. Strontian was first analyzed by Dr. Hope, who described the properties of this newly discovered earth. The constituent parts of the mineral are, according to Dr. Hope:

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strontian</td>
<td>3.675</td>
</tr>
<tr>
<td>Carbonic acid</td>
<td>30.30</td>
</tr>
<tr>
<td>Water</td>
<td>8.5</td>
</tr>
</tbody>
</table>

According to Klaproth, it contains only 0.6 water, and 69.4 of the earth.

This mineral has been found also in Saxony, at Braunfirt, and near Popayan in Peru. Strontian is divided into four sub-species by Werner: foliated celestine, radiated celestine, fibrous celestine, and compact celestine. These are all combinations of strontian with sulphuric acid; this species has been called celestine, on account of its generally inclining to a blue colour. Foliated celestine, strontian sulphate, Hali, sometimes inclines to a reddish-red and pale flesh-red: it occurs massive and crystallized in irregular fixed and eight-sided tables, and in rectangular four-sided tables. The crystals are rather small. The surface of the massive varieties is streaked, and the name is the same with the lateral plates of the tables. The structure is foliated: it has a shining and pearly lustre, and is translucent. It yields to the knife, but is harder than heavy spar: its specific gravity is 3.962. It contains from 54 to 57 strontian, sulphuric acid from 43 to 46, according to the analyses of Vauquelin and Klaproth. This mineral has been found in various situations, and particularly in the vicinity of Britol. Radiated and fibrous celestine differ from the above in their structure merely. Compact celestine has a snow-white or yellowish-white grey or brown colour, and sometimes an ochre-yellow.

It occurs in spheroidal or kidney-shaped masses, imbedded in mottled clay with granite, at Kemptmars near Paris, and is said to form a whole bed in Champagne. It is supposed to be derived from the oxyd of iron. Its specific gravity is 3.597. It consists of:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphate of strontian</td>
<td>91.42</td>
</tr>
<tr>
<td>Carbonate of lime</td>
<td>8.33</td>
</tr>
<tr>
<td>Oxyd of iron</td>
<td>0.25</td>
</tr>
</tbody>
</table>

All the varieties of celestine melt before the blow-pipe into a white friable enamel, without feebly tingling the flame. After a short exposure to heat it becomes opaque, and has then acquired a slightly caustic and acid flavour, very different from that which heavy spar acquires by a similar treatment.

STRONTIAN, in Geography, a village of Scotland, in Argyleshire, on Loch Sunart, celebrated for a new species of fofil, called "Strontia." It is in the vicinity of lead-mines, and inhabited by miners. N. lat. 56° 40'. W. long. 5° 38'.

STROOM ROCK, a rocky island in the Orkney of Suna. S. lat. 5° 51'. E. long. 105° 50'.

STROP, in a Ship. See Strap.

STROPHADES, in Ancient Geography, two islands of the Ionian sea, 400 stades from the coast of Peloponnesus, over against and west of Yparia, according to Strabo. His mythologists place the Harpies.

STRO-

Gen. Ch. Cal. Perianth inferior, of one leaf, in five deep, ovate-oblong, acute segments. Cor. of one petal, funnel-shaped; crowned in the throat with ten undivided scales; limb in five segments, each terminating in a very long, taper, more or less contorted, point. Nectary of five scales below the germen. Stam. Filaments five, awl-shaped, short, inserted into the middle of the tube; anthers erect, conveging, arrow-shaped, pointed or awned. Pith. Germen of two lobes; style simple, thread-shaped, dilated upwards; stigma nearly cylindrical. Peric. Follicles.

Eff. Ch. Corolla funnel-shaped, with ten undivided scales in the tube; segments of the limb with very long tails. Nectary of five scales below the germen. Follicles.

Obs. This genus, according to the authors cited, differs from Nerium in the long appendages to its corolla, as well as in the ten undivided, not torn, scales which crown the tube, and the presence of glands below the germen. Ecbites differs from both in having no scales in the tube or throat of the corolla. Four species are described, all tropical shrubs, of a tender trailing habit, with opposite, simple, undivided leaves. The flowers are small and white, on short, mostly aggregated or tufted, flower-flax. They are figured by Decandolle in the Annales du Mufen; and his essay, with the figures, is copied in a periodical French work, entitled Bulletin des Sciences, not at present within our reach. The species are thus distinguish'd.

1. S. farinosis. Decand. n. 1. — Smooth, trailing. Flowers aggregate, terminal and lateral, accompanying the leaves. Corolla nearly bell-shaped. Anthers with elongated capillary points.—Gathered at Sierra Leone, by the late Mr. A. G. Bottle; by Dr. A. C. Wilkins. The branches are very long, round, smooth, purplish, somewhat warty, flowering copiously about their extremities. Leaves flaked, ovate, pointed, entire, quit smooth, two or three inches, perhaps more, in length; paler beneath. Flowers chiefly lateral, in short, forked, opposite tufts. Corolla (if we rightly recollect a drawing once in the possession of Sir Joseph Banks) white, beautifully point'd with purple; its tube is wide, above an inch long; the taper appendages to its limb four times that length, not evidently spiral in our dried specimens, except in the bud. The scales which crown the tube have also long taper points.

2. S. laurifolius. Decand. n. 2. — Smooth, Leaves opposite or ternate. Flowers aggregate, terminal, coming after the leaves. Anthers with elongated capillary points.—Found by Mr. Smeathman at Sierra Leone.

3. S. dichotomus. Decand. n. 3. (Ecbites caudata; Linn. Mant. 52. Wild. Sp. Pl. v. 1. 1240. Burm. Ind. 68. t. 25.) — Smooth. Branches forked. Leaves pointed. Tube of the corolla cylindrical, thrice as long as the calyx. Anthers with very long linear points.—Native of Java, in elevated situations. The Malay name is Musang. The stem is shrubby, fibritated, throwing out long, slender, smooth, twining branches. Leaves on shortish flarks, elliptical with a short point, entire, quite smooth, three or four inches long. Flower-flaeks from the forks of the branches, bearing three or four large, smooth, yellowish or tawny flowers. Segments of the calyx lanceolate, taper-pointed. Tube of the corolla near an inch long; tails of the limb three inches, obtuse, flat, not spiraled after the flower is expanded. The points of the anthers seem to be near an inch long, linear and membranous, cohering in the form of a slender tube.

4. S. biflorus. Decand. n. — Very brily. Tube of the corolla cylindrical, half as long as the calyx. Anthers acute, without points.—Gathered by Mr. Smeathman at Sierra Leone. Every part of this plant, even the calyx, is rough with tawny brily hairs. The corolla is downy; its very long and peculiarly slender tails hairy at the back. Leaves elliptical, pointed; their ribs and veins fringed with long defrilled hairs. Flower-flaeks cymose, forked, with long, lanceolate, obtuse bractes. Segments of the calyx lanceolate, as long as the whole corolla except its tails, which are five or six times as long, measuring about four inches. The flower-tube resembles a long slender hairy pill, nor have the tails, even in that state, much of a spiral aspect. Nothing has been observed of the fruit of this or any other species. There being two separate germen, as in so many of this natural order; and the close affinity of this fine genus to Nerium and Ecbites, leave little doubt of its seeds-offer being similar to their's.

STROPHE, in the Greek and Latin Poetry, a stanza, or certain number of verses, including a perfect quae; succeeded by another, confining of the same number and measure of verses, and in the same disposition and rhythmus, called antistrophe.

STROPHARIUS, among the Romans, a person who prepared and made the opopha. See STROPHIUM.

STROPHIUM, in Botany, and Vegetable Pharmacy, a little curved appendage, as the name imports, to the ear or base of some seeds. It is either of a fungs, glandular, or callous nature, and may be found in Ajonum, Caesia t. 141; but especially in several papilionaceous genera, as Ulex, Spartium, Bassana, and Platysobium. The elastic tuning of the seeds in Oxalis has been mistaken for a Strophium by some botanists.

STROPHIUM, among the Romans, a short swath or band, by which the young women kept down the dwelling of their breasts.

STROPHIUM was likewise a bandage for the head, made of two or three garlands of flowers tied together.

STROPHULUS, in Medicine. See INFANTS.

STROPPEN, in Geography. See SLEIFS, in the principality of Oels; 24 miles W.N.W. of Oels. N. lat. 51° 22'. E. long. 16° 49'.

STROPPO, a town of France, in the department of the Stura; 13 miles S.W. of Saluzzo.

STROPPUS, among the Romans, the thong with which the oars were tied to the scullus.

STROTH, FREDRICK ANDREW, in Biography, a German writer, was born at Triebles, in Swietish Pomerania, in the year 1750; and became first rector of the school of Quedlingsburg, and afterwards had the same office in that of Gotha.
Gotha. He was the editor and translator from the Greek into German of the works of several ancient authors; and a contributor to the German critical journals, particularly those of Halm and Halle. He died, at an early age, in the year 1785. Among his works are enumerated the following: 

1. "Chrestomathie Latina, etc." Quedlin. 1775, 8vo.; 
2. "Chrestomathie Graeca, etc." ibid. 1775, 8vo.; 
3. "Eusebii H. E. lib. x. et, etc., Vit. Conflant. lib. iv. etc." Hal. 1779, 8vo.; 
5. "T. Livii Oper. Pentas L., etc., Lib. 1780; 
6. "Pentas II." Goethe, 1783, 8vo.; 
7. "Theocriti Idylli Graec. etc." ibid. 1782, 4to.; 

STROUD, in Geography, a river of England, which runs into the Severn, 5 miles S. of Gloucester.

STROUD, a market-town in the hundred of Bisley, and county of Gloucester, England, is situated 10 miles south from Gloucester, and 102 miles west from London, on the ridge of a declivity near the confluence of the river Frome and the Slade-water; and may be considered as the centre of the clothing manufacture in this part of the country. All the surrounding valleys exhibit a continued range of villages, or hovels, inhabited by poor people engaged in trades. Though the scenery of this district is beautiful, yet the steep ascent, and irregularity of the ground, render the roads fatiguing to the traveller. At the time of the Domedal day survey, this manor appears to have been comprehended in the adjoining parishes of Bisley: it now belongs to Peter Watts, Esq. The church, which consists of a nave, chancel, and side aisles, with a tower and spire at the west end, has been erected and repaired at different periods. An endowed school, and several charity-schools supported by subscription, have been established here. The inhabitants of this parish, as returned to parliament in the year 1811, amounted to 5221; the number of hovels to 1184. A weekly market is held on Fridays, and two fairs annually. John Canton, an ingenious natural philosopher and mathematician of the 18th century, was born at Stroud in the year 1718.—Beauties of England and Wales, vol. v. by J. Britton and E. W. Brayley.

STROUD’S BAY, a bay on the north-west coast of Barbadores; 6 miles N. of Speight’s Town.

STROUDSBURG, a town of America, in the road from Lexington in Kentucky to Virginia; 17 miles N.E. of Lexington.

STROUD-WATER. See Stroud, supra, and Casco Bay.

STROYL, in Agriculture, a term applied to couch, or other weeds; or the roots of weeds either harrowed or raked up upon the land.

STROZZI, Tito VESPAIANO, in Biography, a Latin poet of the 15th century, belonging to the famous Florentine family of that name. He was one of four sons, whose father caused them to be well instructed in public literature. Tito studied in poetry and eloquence under Guarino, at Verona. He married in 1470, and was made a cavalier by duke Borso. He furnished some considerable offices at Ferrara, and was employed as the ambassador of duke Hercules at the papal and other courts. His death is said to have occurred in 1505. He wrote many Latin poems, amorous, serious, and satirical; and having planned a long poem in praise of duke Borso, he wrote ten books, but did not live to complete it. Aldus printed a collection of his productions, but many more were left in MS. As an author he displayed a degree of facility and elegance, which was not common soon after the revival of literature.

STROZZI, ENCO, son of the former, who was occupied, like his father, in the magistracy of Ferrara, but excelled him in the province of literature. He is highly commended by Caligiani, in his funeral oration, as an admirable writer in prose and verse, both in Latin and Italian; and in Greek also he wrote a poem on the war of the Giants, which happily imitated the style of Homer. His moral qualities were much esteemed, and he was the distinguished patron of literature and merit. Duke Hercules I., who was much attached to theatrical spectacles, employed Strozzi in planning them. He was likewise the heir of cardinal Bembo. Having married a lady, named Barbara Torella, to whom a pension of high rank was attached, the disappointed lover caused him to be assassinated, in 1508, with circumstances of peculiar aggravation. His Latin poems are reckoned among the most elegant of that period. They were printed, together with those of his father, at Venice in 1513, and at Paris in 1530. Tiraboschi. Gen. Biog.

STROZZI, FILIPPO, a Florentine of an ancient and opulent family, and one of the richest citizens of Florence, in the early part of the 16th century, became related, by his marriage with Clarice, the niece of pope Leo X., to the family of Medici; but by his attachment to the ancient republican constitution of Florence, he could not acquiesce in the arbitrary government of that house. After the death of pope Clement VII., when the sovereignty was possessed by duke Alexander de Medici, he joined the party who aimed at retreating a free government. Failing to obtain support from the emperor Charles V., he attempted to engage Lorenzo de Medici in a conspiracy for assassinating Alexander. Lorenzo objecting to his proposal, that if it failed, his private and family interests should be endangered, Filippo promized, in case of failure, to marry him to two of his own sons. When Lorenzo, in consequence of the deed, fled from Florence, this promise was fulfilled. In order to reestablish the establishment of Cosimo, as Alexander’s successor, Strozzi put himself at the head of a body of troops; but being defeated in the battle of Marone, he was made prisoner. Dreading the torture, of which he was apprehensive for not disclosing his accomplices, he determined to anticipate the trial by suicide. Some facts have once endured the torture with great firmness. A pinnard having been negligently left in his apartment, he made use of it to write upon the mantle-piece the line from Virgil,

"Exoriate aliaquis nostris ex olibus ulteri?"

and then pierced his breast. In his testament, he charged his children to remove his bones from the place of their interment at Florence to Venice, that, after his death, they might be deposited in a free country. He died in 1538. Strozzi possessed the highest dignities at Florence, without price or ostentation; and to such a degree was he attached to the republican equality, that he was offended by being called "Meffire," instead of Philip. "I am," he would say, "neither an advocate nor a cavalier, but simple Filippo, the son of a merchant." His sons, removing to France, engaged in the king’s service, against Charles V., the patron of the Medici. One of them became a marshal of France, and was succeeded in the post by his son. Bayle. Gen. Biog.

STRUCHIUM, in Botany, a name adopted by Browne, we cannot tell with what intention. See Estrulia, and Sparanophorus.

STRUCTURE, in Architecture. See Building.

STRUCTURE, in Architecture.
STRUCTURE of Minerals, in Mineralogy, is one of the most important external characters of minerals. Structure is defined by Brongniart to consist in the arrangement of the integral molecules of a mineral;this arrangement may be more or less regular; it exists in the fibres in whatever fragments it may be broken. (Traité Élémentaire de Mineralogie.) The principal modifications of structure are, according to the French mineralogists, either laminar, lamellar, flatiform, foliated, fibrous, radiated, or compact. Of these, the flatiform more properly belongs to rocks.

The laminar structure consists of larger laminae, or planes; it is by observing the inclination of these planes to each other, that the primitive form of the crystal is discovered. Werner calls the direction in which the planes separate, the cleavage.

The lamellar structure presents smaller laminae, dispersed in different directions, as in flinty marble.

The foliated structure presents thin separable layers, as in slate.

The fibrous consists of minute parallel fibres, as in fibrous gypsum.

The radiated consists of diverging fibres, as in melo-
type.

The compact presents no distinguishable separation into parts, as in Jasper.

Mr. Aikin defines structure "to be that division of a whole into smaller aggregates, which has been made by Nature according to general laws;" and fracture to be "the casual division of a whole into fragments." These characters have been improperly confounded by the Wernerian mineralogists, but are essentially different; the fracture may vary according to the strength of the stroke by which it is produced; the structure is an invariable character. The structure of minerals is either perfectly crystal-
line, imperfectly crystalline, or promiscuous. The crys-
talline structure consists in the regular arrangement of the particles of a mineral into definite symmetrical forms. (See Crystal.) Every perfectly crystallized mineral has parallel planes of section in three or more directions. These planes of section are by some mineralogists denominated the joints. In some minerals these joints are so open, that a flight blow will cause a separation of the parts into regular fragments. In other minerals the joints are concealed, and the planes adhere so firmly, that a fracture will take place in an oblique direction to that of the planes, of which the rock is an example. The joints in one direction may often be easily detected, but may be concealed in another, of which we have an instance in the topaz. In massive specimens, the existence of parallel joints is the only indication of a crystalline structure. In transparent minerals, the direction of the joints may often be detected by turning the mineral slowly round in a very strong light; the internal reflections showing the surface of the planes of section. When this fails, heating the mineral, or a portion of it, red-hot, and allowing it to cool gradually, will often open the joints.

The imperfectly crystalline structure, includes all the varieties of form in which a tendency to crystalline arrangement can be perceived. The first deviation from a regular crystalline structure, is where the joints are more or less curved; this is sometimes connected with a regular external form, as in the spheroidal diamond, and in pear spar; and sometimes occurs massive, as in curved lamellar heavy spar. The next deviation is where the laminae are long and thin, more or less resembling the blade of a knife, and have often a sharp edge on one side. These blade-shaped laminae are rarely parallel, but generally crose, as in common hornblende and cyanite.

The last variety of structure passes into the fibrous, in which the fibres are either parallel or radiated; when radiating on one side, they are called radiiform; when diverging in opposite sides, radiated; and when diverging on all sides, radiated.

In some cases, two different modes of structure are combined, a mineral presenting a fibrous structure in one direction, and a lamellar structure in another.

The promiscuous structure consists of different concretions, forming a maf, either by means of a small proportion of cement, or by a flight degree of mutual cohesion. It may consist of globular concretions, as in roe-flone and oolite, or of granular concretions, as in sand-flones. The granular concretions may be so small, as to be imperceptible without the aid of a lens. When the division of parts is visible in a mineral, it is said to be compact.

STRUCTURE of Rocks, in Geology, denotes the mode of aggregation of the mafes of which rocks are composed: the external structure may be stratified, schistose, tabular, columnar, or globular. The internal structure denotes the mode of aggregation of the substances of which the larger mafes are composed, and may be porphyritic, granitic, amygdaloidal, or conglomerated, &c. See Rocks, and Strata.

STRUCTURE of the Earth. See System.

STRIENSEE, John Frederic, in Biography, was the son of a clergyman of Halle, in Saxony, and born at Halle in 1737. At an early age he manifested very promising talents, and devoted himself to the study of medicine; and having taken his degree of doctor in 1757, he removed to Altona; and there obtained extensive medical practice. Besides the acquaintance he formed with two persons, viz. count Von Ranzau Aichberg and count Brandt, connected with his subfrequent fate, he acquired also, in the course of his practice, the friendship of the widow of the chief marshal of the court to Frederic V.; and thus was honoured with an appointment, in 1768, to be one of the physicians of the king, whom he accompanied in his tour to Germany, France, and England. Soon after the marriage of Christian VII. with Matilda, the English princess, an open rupture succeeded a coolness that was observed to subsist between this prince and the queen. The queen-dowager availed herself of this circumstance, with a view of recovering her lost influence. The misunderstanding between the two queens was increased on the birth of the crown-prince; and the king's tour contribute to lessen his indifference towards his comfort. On his return, the discontent was manifested more openly and decisively; and divided the nation into two parties. The most numerous party was supported by the minister and the principal officers of state; and at the head of it was count Holk, the king's favourite. The queen-dowager had her partizans at Fredericksburg; and some young persons, who had neither influence nor property, took part with Matilda, and entertained hopes that, on account of her youth, beauty, and engaging manners, a reconciliation might be effected between them. The young queen, however, well knowing that these friends had no experience in court intrigues, formed her own plan; and determined to make every possible effort for depriving count Holk of the royal favour, and thus of regaining the confidence of the king. Holk, for his own security, endeavoured to widen the breach between the royal pair; and conceiving that Struensee hated the queen as much as he himself did, he persuaded his royal master to take Struensee with him,
whenever he visited the queen. But, contrary to Holk's expectations, the king became attached to Struensee; and the queen, remarking this change, became gradually familiarized to his company; and her aversion to him was succeeded by an admiration of his talents, his wit, and his extensive knowledge. The crown-prince being at this time inoculated for the small-pox, under the superintendence of Struensee, the queen informed him, that, in recompense of his services, he should be entrusted with the prince's education. Struensee having succeeded in the operation, was made a counselor of conference, with a salary of 1500 dollars, and appointed reader to the king and queen. This new favour succeeded in his endeavours for peace; and complete reconciliation between the king and his royal comfort; which was followed by an indifference, on the part of the former, towards Holk. Bernstorff, the minister, became jealous of Struensee, and attempted, though unsuccessfully, to undermine the confidence reposed in him by the king and queen. Soon after, the court made a tour to Schleswig; and the heads of the different parties composed the royal suite. The queen behaved to both parties in the same courteous manner. Brandt succeeded Holk in the king's favour and confidence; but Bernstorff, though mortified by the loss of his influence over the king, declined making a voluntary resignation. His fate, however, was soon determined, and intimation was given him that his services were no longer necessary. The remaining members of government were dismissed, and the administration was formed by the friends of the queen and of Struensee. During these events, the queen-dowager remained at Friedeburg, watching their progress, and condescending with the discarded ministers. The queen at length obtained a complete triumph. The king behaved to her with the affectionate benevolence which he ever displayed; and Struensee possessed her confidence, and employed all possible means to retain it. The king, naturally of a weak mind, was secluded from society by Struensee; and Brandt was commissioned to keep him constantly occupied with amusements. The king was gratified by this mode of life; the influence of Struensee was augmented; and he at length accomplished his main object, which was that of preventing his majesty from perilously transacting any business with his ministers. In process of time, or towards the close of the year 1770, a complication occurred, which served to place unlimited power in the hands of the young queen and her ministers. Struensee neglected no means to increase his power; and in order to retain it more securely, he prevailed on the queen to commit to his management the whole business of the cabinet. In consequence of this measure, the whole form of the government was new-modelled; and public business was transacted in the king's name, by those immediately around him. But Struensee's paramount power was of no long duration. His boldness, approaching to the highest degree of insolence, degenerated into timidity, when any of his measures were opposed; and though he conducted foreign affairs according to the principles of sound policy, his internal administration, perplexed by avarice or ambition, did not answer the purpose intended. The various measures which he projected for the improvement of the government and country, and which our limits will not allow us to detail, excited disgust and dissatisfaction among persons of every rank and condition, from the highest to the lowest. Struensee, however, was indefatigable in the complicated duties of his office, and sedulously attentive to the education of the crown-prince. Two of his brothers were advanced to stations of importance; one in the new college of finance, and the other in the department of war. Brandt, Berger the physician, and other confidential persons, remained constantly near the king's person, nor were any others, suspected to be adverse to the existing order of things, permitted to have any intercourse with him; so that his indifference to public business gradually increased, and his capacity for conducting it diminished. In July 1771, the queen was delivered of a princess; and as she knew the furnaces, originating at Friedeburg, that were circulated on this occasion, she was not unapprehensive that they might serve as pretenses to wrest from her the power which she had acquired. She was unfortunately deprived of this on Struensee, who, by the advice of his minister, had become an object of detestation. Not content with being enrolled in the list of the Spanish nobility, and being created count, he invented a new title, or that of private counsellor of the cabinet, and with this he acquired a degree of power which had never been enjoyed before by any minister of Denmark. In fact, it was this ambitious minister's aim to annihilate the royal authority; and in the circumstances then existing, and under the pretence of the queen, if he had conducted himself with more prudence, he would have produced the machination on which he had been ruin. His friends, probably foreseeing his fall, became cool and indifferent; and the people in general, while they despised his power, executed his name. A spirit of discontent pervaded all ranks; the sailors and the soldiers complained of his conduct; and the populace joined the malcontents in their opposition and murmurs. The dissatisfaction and tumult that prevailed increased Struensee's timidity: his measures were indecisive, and his situation became every day more dangerous. The British minister, actuated by a respect for the young queen, endeavored to hasten his downfall, and thereby weaken the principality. Accordingly, he offered him a sum of money to enable him to quit the country. The queen, apprehending that her enemies would get the king into their hands, and obtain possession of all the royal power, opposed this measure. A crisis, however, was approaching; and Struensee could no longer refuse or control the counsels and operations of those who were hastening his downfall. Notwithstanding the measures which he adopted for infuring his own personal safety, and which were interpreted by the people into a breach of the sacred trust of his office, everything conspired not only to accelerate his own ruin, but to further the plan which had been formed against the young queen. On the morning of the 17th of January, 1772, the inhabitants of Copenhagen heard, not without astonishment and terror, that this prince, Count Struensee, his brother, Count Brandt, and all their friends and adherents, had been arrested in the night. At 3 o'clock in the morning, succeeding a ball that had been given at court the preceding evening, and after the queen had closed about 1 o'clock with Prince Frederick, colonel Koller, an inveterate enemy of Struensee's, whose regiment was on guard at the palace, informed his officers, after having admitted them into the palace, that he had the king's orders to take the queen into custody. The officers, without requiring to see the orders, which would have defeated the whole plan, implicitly obeyed. Ranzau hurried into the king's bed-chamber, and drawing the curtains so as to awaken him, told him before he had time for reflection, that his life was in danger. "What must we do?" said the alarmed king: "Shall we fly? and by me: give me your advice."—"Sign this," replied Ranzau, "it will save my sovereign and the whole royal family." Thus took hold of his pen, but let it drop as soon as he cast his eye
on the name of his comfort. At length he suffered himself to be perfused; and Ranza, supported by colonel Eich- 
stadt, whose dragoons surrounded the palace, and some other 
officers, carried out the fatal order; and, in a manner the 
most violent and brutal, seized the perf of the unfortunate 
Matilda, and conveyed her in a carriage to the castle of 
Cronenburg. Strueneef's arrest was followed by the ap-
pointment of a commissary for his trial; and the proceed-
ings against him were carried on with great zeal and se-
verity. The indictment, drawn up by the fiscal general in 
very intertemperate language, and delivered to the court on the 
21st of April, 1772, after relating the circumstances of his 
life and character, stated nine articles as capital charges.

"For many years before his fall," says his biographer, who has compiled his article from a variety of original documents, 
and of which we have freely availed ourselves, "Strueneef 
had lived an avowed free-thinker. He was convinced, 
however, of the existence of a Supreme Being, by whom the 
world was created; but he considered mankind as mere 
machines, governed by no moral principle; looked upon 
a future state as an idle dream; and believed that after 
death, a man had nothing to hope or to fear. During the 
first week of his imprisonment, he endeavoured by these 
principles to compose his agitated mind; and giving way 
also to the warmth of his imagination, fancied that a thou-
sand circumstances might occur to liberate him from his 
dangerous situation. He was thus able, for a little time, 
to bear up under his misfortunes, and to assume an apparent 
cheerfulness; but these were merely palliatives, which 
soothing their effect, he soon fell into a state of the most vi-
olent anguish and dismay. At last, however, which he re-
ceived from the celebrated Dr. Munter, (see his article,) 
a clergyman of Copenhagen, who went to see him in prison 
the 18th of March, 1772, laid the foundation for a change 
in his sentiments, which enabled him afterwards to support 
his sufferings with more fortitude and resignation. This 
worthy man discoursed with him proofs of Christianity; 
listened to his doubts and objections, and answered them in 
the mildest yet most forcible manner; and at length gained so 
much upon his heart, that he gave himself up entirely to his 
direction.

"When his trial came on, his advocate, in a short 
written defence, endeavoured to disprove all the charges 
that had been brought against him, with the exception of 
one, which was the di repect personally shown to the 
king. Of this he acknowledged himself guilty, was 
heartily sorry for it, and threw himself on the mercy of his 
offended sovereign. The court, however, which had re-
solved that Strueneef should suffer an ignominious death, 
rejected all representations made in his favour, and on the 
27th of April passed the following sentence: "That after 
his right hand had been cut off, he should be beheaded; 
that his body should then be quartered, and in that state 
publicly exposed; and that his head and hand should be 
affixed to a pole." On the next day, April the 26th, Dr. 
Munter paid him a visit, and informed him that this sen-
tence had in every point been confirmed by the king; and 
that the 28th was the day appointed for its being car-
ried into execution. The unfortunate court heard this 
intelligence with the utmost compo 
sure; and declared, that, in regard to the ignominious circumstances attending his 
doom, he was perfectly easy, as he believed in a future re-
futation. He spent the intervening time in a manner be-
coming his situation, and suffered according to his sentence, 
along with his friend Brandt, who had also been condemned, 
amidst an immense concours of spectato 

STRUFERTARI, among the Romans, persons hired to perform some kind of sacred rites near trees that had been 
thunder-struck.

STRUGA, in Geography, a town of European Turkey, 
in Macedonia; 10 miles S. of Akrida.

STRUM, in Rural Economy, a term signifying the ho 
used in brewing, &c. to keep the tap free. It is common 
ly made of straw cut in a neat short manner.

STRUMAE, formed, as some will have it, from 
strana; because they grow in the form of a 
stratum, stratum aurantium, in Medicina 
and Surgery, tumours arising most usu 
ally on the neck and throat; called also for 
folia, and popularly the evil, or king's 
evil. See SCROFULA.

The Greeks call them χαρακτικά, forces. See EVIL AND 
BRONCHOCLE.

STRUMARIA, in Botany, derived from struma, a wen, 
or swelling; and applied by Jacquin to this hand 
ITEMGENUS 
on account of the tumour at the base of its stye.—"Jacq. 
Kew, c. 2. 212. Lamarck Dict. v. 7. 422. Clas and 
Narcissi, Jull.

Gen. Ch. Cal. Sheath of two, unequal, oval, pointed 
leaves or valves. Cor. Petals six, superior, spreading, 
the three outer ones generally carinated at the back. Stam. 
Filaments six, inserted into the receptacle, shorter than 
the corolla, equal, awl-shaped; anthers oval, or roundish. 
Pil. Germen inferior, triangular, three-furrowed; tyline 
longer than the filaments, inserted from the base to its centre, 
awl-shaped upwards; stigma trifid. Petio. Capsule oval or 
roundish, slightly triangular, with three furrows, three 
cells, and three valves. Seeds numerous, round.

Eff. Ch. Petals six, spreading. Style thickened below 
the middle. Stigma three-cleft. Capsule inferior, roundish, 
of three cells.

Jacq. Ic. Rar. t. 356. Leaves linear-lfork-shaped, flat, 
obtusely rounded at the tip. Stalk round; compressed up-
wards. Stamens the length of the corolla.—Native of the 
Cape of Good Hope, as are all the remaining species— 
Root perennial, bulbous, with narrow fibres. Stalk a foot 
high, simple, erect. Flowers in a fork of umbel, on flcakes. 
Petals white, greenish on the outside and at the tip. 
Sheath shorter than the flower-flanks, pink or reddish.

Ic. Rar. t. 357. Leaves linear-lfork-shaped, flat, obtusely 
rounded at the tip. Stalk compressed. Stamens longer 
than the corolla. It flowers in April and May. Root 
perennial, fibrous. Stalk more than a foot in height, erect. 
Flowers in a handsome umbel. Petals white, pink on the 
outside. Sheath reddish.—The filaments of this species 
as well as of the last adhere to the base of the stye. It is also 
very similar in habit, but differs in having more flowers 
and much longer flmannas.

Ic. Rar. 358. Leaves linear, waved in an oblique manner. 
Petals flat.—It flowers in May and June.—Root perennial. 
Stalk a foot and half high, slender. Nearly waved. Flowers 
in a small umbel, pink-coloured, a little drooping. 
long filaments adhering to the base of the stye.

Jacq. Ic. Rar. t. 360. Leaves linear, waved in an oblique 
manner. Petals undulated.—Root perennial. Stalk a foot 
high, erect. Flowers in a loose umbel. Petals narrow, 
undulated, pink at the tip.

5. S. angustifolia. Narrow-leaved Strumaria. Wildl. n. 5. 
Jacq.
Jacc. Lc. Raf. t. 359.—Leaves linear, flat. Germin with three glands.—It flowers in April and May.—Root perennial, small. Stalk a foot high, slender, waved. Flowers irregularly umbellate. Petals white, with a pink line at their back; yellowish before expansion. This species is remarkable for having three glands on the germin.


7. S. spiralis. Spiral-flaked Strumaria. Ait. n. 5.—This species, now very properly referred, in the Hortus Kewensis, to Strumaria, is described in this work under the name of Hemantis spiralis. (See Hemantis.) Mr. Salisbury, in his Paradisi Londinensis, t. 63, considers it as a new genus, and calls it Carpolyza.

STRUMBLE'S HEAD, in Geography, a cape of South Wales, on the N. coast of the county of Pembroke. N. lat. 50° 41', W. long. 5° 12' 30".

STRUMENBACH, a river of Carinthia, which runs into the Gril, 8 miles N. of Tarvis.


Gen. Ch. Cal. Perianth superior, minute, of one leaf, erect, with five sharp teeth, permanent. Cor. Petals five, ovate-oblong, obtuse, spreading. Stam. Filaments none; authors five, united into an ovate body, rather shorter than the corolla, marked with five furrows, and very slightly five-toothed at top and bottom. P. I. Germin inferior, roundish; style awl-shaped, erect, projecting rather beyond the ovary; stigma simple, obtuse. Peric. Berry roundish, umbilicate, crowned with the calyx, of one cell. Seed solitary, roundish.


1. S. maritima. Linn. Sp. Pl. 1316. Jacc. Amer. 218. Wildl. n. 1. (Thymeloea fruticeae, rostrinian folio, flore albo; Plum. Lc. 249. t. 251. f. 1. T. humilorum, folia acutia atroviolaceae; Sloane Jam. v. 2. 93. t. 189. f. 1, 2.)—Gathered by Jacquin in Corapoa, on rocks near the sea, especially in the suburb called by the Dutch de kip. Sloane found his plant near the Palifados, by Port Royal in Jamaica. Nobody since seems to have met with the Strumpfia. Our only knowledge of it is from the accounts and figures of the above authors, and a fragment of Jacquin's original specimen, without leaves or flowers, given us by Sir Joseph Banks, who purchased his American herbarium. The stem is said to be shrubby, erect, three feet high. The branches (in our specimen) are round, closely clothed with fine hoary down, and appearing as if jointed, from the frequent, long hairs, which mark the insertion of the leaves and stipulas, both which originate from one common annular protuberance. The leaves grow three in a whorl, nearly sessile, and are lanceolate, entire, rather above an inch long, said by Jacquin to be very like those of Rosemary. Stipulas alternate with the leaves, spreading, awl-shaped, a line or two in length, dark-brown. Flower-flaks axillary, half the length of the leaves, each bearing about five small flowers, on short partial flaks. Petals white. Berry soft, white, the size of a small pea. The whole plant has a disagreeable, though not powerful, smell.

There cannot be much doubt of this genus belonging to the Campanulaceae, as that order stands in Jfff.; but whether it should still remain there, or be transferred to Mr. Brown's Goodeniaceae, may admit of a question; chiefly because of the berry and foliage habits. The author however feems not very decided in his division of the original order, and his limitations may therefore be received with the more latitude.

STRUMUS, a name given by some of the old Roman authors to the cucubulus, or berry-bearing chick-weed.

It had this name from its being found of service in strumous and scrofulous swellings, when externally applied. The name cucubulus feems to have been derived from the word Sabacaculum, or the winter-cherry, for the ancients esteemed both these plants species of nightshade; and some of them have plainly described the cucubulus under the name of fulmen hoerti.

STRUNKEDE, in Geography, a town of Germany, in the county of Mark; 2 miles N.W. of Catropp.

STRUNTJAGGER, Artic Bird, or Larus parasiticus, in the Linnaean system of Ornithology, is a species of gull found in the Hebrides and Orkneys, with a dusky hooked bill, and narrow nollirs. In the male, the crown of the head is black; the back, wings, and tail, dusky; the hindpart of the neck and lower side of the body white; the tail confits of twelve feathers; the legs are black, small, and scaly; the female is entirely brown. See Larus.

These birds pursue the leffer gulls till they mute for fear, and catch up their excrement, and therefore they are sometime called dung-busters, as well as another species of the gull called marinae.

STRUPT, among the Romans, garlands or wreaths of vevain, with which the flutes of the gods were crowned.

STRUUCHNETZ, in Geography, a town of Bohemia, in the circle of Konigigratz; 8 miles N. of Gfitschin.

STRUFT, a term used by some builders for that brace which is framed into the king-piece and the principal rafter.

STRUITHIA, in Ancient Geography, a town of Asia Minor, in Phrygia, on the confines of Lycaonia.

STRUITHIA, in Botany, a name originally given by Van Royen to the Gnidia of Linneaus; and which being derived from Stisios, a sparrow, appears to have had in view the near affinity of that genus to Paffieria. See Gnidia and Passerina.

STRUITHIO, in Ornithology, a genus of birds of the order Gallin. Bill subconic; nostril oval; wings short, unfit for flight, feet formed for running. There are four species.

Though the power of flying may be considered as the distinguishing characteristic of the feathered tribes in general, yet there are some families to which Nature has denied that endowment, while the feems to have granted it to a few quadrupeds, and even partially to some fishes. It is thus that she displays the extent of her power, by the variety of her productions, and diffuses to be confined within the narrow limits prescribed to her by the systems of philosophers. In defending from the claws of quadrupeds to contemplate that of birds, we find the connecting links, which unite these orders into one chain, very short, and almost imperceptible; for while the flying squirrel, the bat, and some other quadrupeds, are inverteb with the power of flight, and with 3 C 2 other
other properties of birds, the ostrich, dodo, and caffowary, are by their great bulk confined to the ground, and they indicate by their habits, a near affinity to the four-footed animals. Hence, as we defend from those swift and slender birds, which are destined to move in the higher regions of the air, we find them growing, by almost imperceptible degrees, heavier and less agile, till at length, being wholly destitute of the qualities necessary for flight, they are incapable of rising from the surface of the earth.

Species.

Camelus; Black Ostrich. Feet two-toed. This is the largest of all birds, and from this prerogative, in a great measure, is incapable of flight. Its weight is sometimes from eighty to one hundred pounds: from the top of the head to the ground, it is from seven to nine feet; and its length from the beak to the top of the tail eight feet. When walking, it seems as tall as a man on horseback. The plumage of the ostrich, however, as well as its weight, is an impregnable barrier against its rising in the air. The vanes of the wing-feathers are separate and detached, like hairs, and incapable of making any impression on the atmosphere. Those of the tail, and indeed of the whole body, are of the same structure. They are all as soft as down, and utterly unfit not only for flying, but for defending the body of the animal from external injury. The feathers of other birds have their webs broader on the one side than the other, but thofe of the ostrich have the shaft exactly in the middle. The head, the upper part of the neck, sides, and thighs, are covered with a clear kind of hair, which on the head somewhat resembles the bristles of a hog. The thighs of this bird, in which its great strength seems to lie, are large and musculat; and its hard and scaly legs, which are supported by two thick toes, have a considerable similarity to those of the goat. These toes are of unequal size; the inner, which is both longer and thicker, being seven inches in length, including the claw; the other, which is without a claw, is four inches. It is the only bird that poises eye-lids, and these are fringed.

Though the ostrich be a bird known from the earliest ages, little comparatively is related of its life and habits, since the Scriptures, we have been many comparisons drawn from its manners: as an article of food it was forbidden the Jews. It is mentioned by Aristotle as remarkable for its fecundity. In the parched deserts of Africa, where it refires, and where it runs with precipitation on the approach of an invader, it can rarely become an object of close examination. The race of these birds, though extremely ancient, still remains pure and almost solitary. Like the elephant among the quadrupeds, the ostrich constitutes a genus offering few or no varieties, and is perfectly distinguished by characters equally striking and permanent. It is peculiar to Africa, to the neighbouring islands, and to those parts of Asia that lie in the vicinity of the African continent. It is seldom found beyond the distance of thirty-five degrees from the equator; and as it is incapable of flight, it must, like the quadrupeds of these latitudes, have always been confined to the ancient continent. It prefers for its residence those mountains and parched deserts that are never refreshed with rain, a circumstance which tends to corroborate the report of the Arabs, that these birds never drink. Vast flocks of them are seen in these barren and solitary regions. At a distance they are said to appear like an army of cavalry, and often alarm the caravans that are travelling through them.

Among some nations, the eggs, the blood, and the flesh, have been eagerly sought as articles of food. Whole people have obtained the appellation of Struthophagi, from their partiality for this food. The Romans considered the flesh of the ostrich as a delicacy; and the imperial beast and glutton, Heliogabalus, is said to have had 600 of them slaughtered in one day, in order that he might have the brains served up as a dish to pamper his appetite. At present, the inhabitants of Numidus tame and breed them, to live upon their flesh, and sell their feathers. Their eggs are said to contain as much food as thirty of those of a common hen. The beauty of the plumage of this bird, particularly of the large feathers that compose it, are the chief reason why man has been so active in pursuing him into the deserts, at so much expense and labour. The Arabs, who make a trade of killing these birds, formerly converted their skins into a kind of buckler. The ancients used their plumes as ornaments for their helmets. The ladies in the East make them still an ornament in their dresses, and they are not unfrequently used in this country for the same purpose. In Turkey, the Janizary, who has signalized himself by some military achievement, is allowed to assume them as a decoration of his turban; and the sultan, in the fagiaho, when meditating conquests and feasts of a more gentle nature, puts them on, as the most irrefutable ornament of his person.

The spoils of the ostrich being thus valuable as articles of commerce, the hunting of this bird is one of the most serious employments of the Arabs, who train their fleetest horses for the purpose. Although the ostrich be far swifter than the belt courier, yet by hunters on horseback he is commonly taken; and it is said of all the varieties of the chase, this is the most difficult and laborious. The Arab, when mounted, still keeps the ostrich in view, but without rushing him so close as to make his escape to the mountains, but at the same time so as to prevent him from taking food. This is the more readily done, as the bird takes its course in a wavering and circuitous direction, which is greatly shortened by the hunters, who come up behind, and relieving each other by turns, thus keep him still running. After two or three days of fatigue and famine, he becomes exhausted, and the hunters fall upon him by striking him on the head with cudgels, that his blood may not tarnish the luster of his white feathers. When all possibility of escape is cut off, the Arab, with the greatest of patience, continues the expectation that the whole body will then be concealed from their searchers.

Ostriches, though inhabitants of the desert, and possessed of prodigious strength, are, especially if taken young, neither so fierce nor difficult to tame as might be expected. The inhabitants of Dara and Lyibia render them domestic, like herds of cattle, with scarcely any other means than constantly accustoming them to the sight and society of man; to receive from him their food, and to be treated with gentleness. Besides the use of their feathers, ostriches, in their domestic state, are said to be mounted and rode upon in the same manner as horses. It is allowed by Adamson, that at the factory of Podere, he had himself two ostriches, that run faster than a race-horse with a negro each on their backs. Though these birds may be so tamed that they will suffer themselves to be driven in flocks to and from their stalls, and even to be mounted like horses, yet their stupidity is such, that they can never be taught to obey the hand of the rider, to comprehend the meaning of his commands, or submit to his will. From this intractable disposition, there is reason to apprehend that man will never be able to avail himself of the strength and swiftness of the ostrich, as he has availed himself of those qualities of the horse. The voracity of this bird far exceeds that of any animal whatever; for it will devour every thing it meets with, bones, wood, brack, iron, or leather, as readily as it will grain and fruit, which, in its native wilds, are probably its principal food.
STRUTHIO.

The season at which the ostrich lays her eggs varies very much with the temperature of the climate. Those north of the equator begin to lay their eggs in the beginning of July, while those in the south of Africa defer it till the end of December. Climate and situation have also a great influence on their manner of incubation. In the torrid zone, the ostrich is contented with depositing her eggs in a mass of sand, seemingly scraped together with her feet. There they are sufficiently heated by the warmth of the sun, and seed the incubation of the female only for a little time during the night. But although the ostrich be but little engaged in hatching her eggs, she displays, by continually watching for the preservation of her progeny, all the solicitude of a tender mother. In proportion to the coldness of the climate, the ostrich hatches with more avidity; and it is only in the warm regions, where there is no danger of her eggs being chilled, that she leaves them by day, a circumstance from which the very early incurred the reproach of being delitute of parental affection. So far, however, is this from being true, that she continually watches for their preservation, and, so long as they remain in a helpless state, which is always a longer or shorter period, according to the climate. Neither the size of the eggs of these birds, nor the time necessary for hatching them, nor the number of the young, are exactly ascertained. Arrauwari; Cassowary. Feet three-toed; helmet and dew-laps naked. This bird inhabits the torrid zone, and especially the island of Java, whence it was brought into Europe in the year 1797. Its habitat begins in those temperate climates which are contiguous to the precipices of the ostrich; and as it occupies a region more favourable to the multiplication of the human race, its numbers are continually decreasing, in proportion to the increase of the number of its destroyers. Cassowarys are of various sizes; they have been seen as large as six feet high. The Dutch compare the bulk of this bird to that of a sheep. From the shortness of the legs and neck, they are not to tall as the ostrich, but the body has a more heavy and clumsy appearance. The most remarkable trait in the appearance of these birds is a sort of helmet on the head, which reaches from the base of the bill to the crown. The middle or upper eye-rid is furnished with a row of black hairs, which gives the animal a wild aspect, which the large aperture of the beak renders still more fierce and menacing. The head and upper part of the neck are almost naked, being only covered with short hairs, while the chest and thighs have a blue wrinkled skin. The feathers that cover the body of the cassowary, as well as those for flight, are all of one kind, and of the same blackish colour. They are generally double, having two shafts, that grow from one short trunk, which is fixed in the skin. The small fibres of which the vane are composed, have no little adhesion to each other, which the bird, when viewed at a distance, seems clothed with hair instead of feathers. The wings of the cassowary are still shorter than those of the ostrich, and consequently still more unfit for flying. They are furnished each with four hard pointed quills, resembling darts, of which the length is such that, which is about eleven inches, is a quarter of an inch thick at the root. Its feet are also armed with large black claws, which give the animal an appearance of being formed for hostility. But though supplied with weapons that might render it formidable to the rest of the animal world, the cassowary leads a peaceable and inoffensive life. It never attacks others, and nothing short of necessity will make it defend itself. The movements of the cassowary, when travelling, are awkward and heavy, nevertheless it will, in running, outrun the fleetest horse. It is distinguished by the same voracity which characterises the ostrich, swallowing every thing that is offered to it, unless it be too large for the circumference of its throat; and it polishes the faculty of rejecting its food, when disagreeable, with the same dispatch with which it took it in. The female lays a number of soft-coloured eggs, about thirteen inches in circumference one way, and fix the other; they are of a greenish colour, with dark green spots.

NOVÆ Hollandie; New Holland Caßowary. Feet three-toed; crown flat; thanks serrate behind. This, as its specific name imports, is found chiefly in New Holland, and is seven feet two inches long. The bill is black; head, neck, and body, covered with bristly feathers, varied with brown and grey; throat rather naked, blueish; feathers of the body little incurred at the tip; wings scarcely visible; legs brown.

RHEA; American Ostrich. Feet three-toed, and a round callos behind. This bird is so nearly allied to the ostrich, already described, that it has been considered as a representative in the new continent, to which it peculiarly belongs. It inhabits Guiana, Brazil, Chili, and those immense forests that extend northwards from the mouth of the river Plata, and it has been found as far south as the Magellanic Straits. Formerly, these birds were more widely spread over South America; but, in proportion as population increased, these timid animals fled from the habitations, or became thesubjects of superior power. It is by far the largest bird in the new world. The adults are full six feet high, and the thighs of some of them have been known to equal that of a male colossus. Its beak is long, small head, and flat beak, that distinguishes the black ostrich; but in other respects it has a greater resemblance to the cassowary. The shape of the body is oval; and when fully covered with feathers, approaches to rotundity. Its wings are so short as to be useless for flight, but, like those of the ostrich, probably afford assistance in running. The back and rump are covered with long feathers, which extend and form what, in this animal, is called the tail. The whole upper part of the body is covered with grey plumage, and the under with white. The toes are three, all before; behind there is a calous kind of heel, which supports the bird, and is supposed to affix it in running. It polishes the fame velocity which characterises the former species, and its running is attended with a singular motion of its wings. It raises one for some time above the body, and then drops it to erect the other, and so on, as a bird60. It is, however, remarkable for its velocity, that the fowlers are obliged to lay snares in order to catch them; for they may, in vain, chase them with the twiftest dogs.

The rhea shows the fame indiscriminate voraciouwsness with the ostrich; and it is probable that her eggs are hatched partly by the heat of the sun, and partly by incubation. The young, when first excluded from the shell, are so familiar, that they will follow the first person they happen to meet with; but upon growing older, they acquire experience, and become more shy and fulgicious. The flesh of the young rhea is of a white colour, but it might probably be much improved, and the race rendered more abundant by domestication, as has been the case with the turkey and hen, which originally came from the torrid zone. The rhea defends itself with its feet, and calls its young by a kind of hfe.

STRUTHIOOLA, in Botany, derived from Cyphos, the diminutive of Cyphos, a sparrow. This Greek name is expressive of the same idea as Pufferina, to which genus the present is analogous in the shape of its seeds, which are pointed like a sparrow's beak.—Linna. Mant. 4. Schreb. 86.
STRUTHIOPSIS, in Natural History, a name given to a series of flies, of the class of those which do not feed on flesh: these have remarkable short wings, and are always found on flowers and leaves of plants. There are several species of these. The most frequent among us are a white-bodied one with black wings, which cover but a very small part of the back, and with feathered wings; and two others with long bodies, of a dusky grey, streaked with white. These are all early flies, being found in the spring in hedges and bushes.

STRUTHIOPTERIS, in Botany, was so called from ἔτοιμος, in its secondary sense, οὐ τοίμος, or ἔτοιμος, in large and elegant fronds are not unworthy to be compared to the noble plumes of that bird. See ONOCLEA.

STRUTHION, in Natural History, a name given by the Greeks to a plant called by the Latinas lanaria herba, from its use in the manufacture of their wool. Many have supposed the chafeyfa of the ancients to be the same with this plant, but this is an error, for the chafeyfa of the Greeks is the antirrhinum of the Latin, as is plain from Pliny; and the same author tells us that it has leaves like those of an iris, small, narrow, and smooth. All the accounts we have of the struthion is from Dioscorides, who says that it was a kind of thistle, somewhat resembling the sycamor, and having a large root, long, and of the thickness of two or three fingers, and very hard prickles on the leaves. This short account, though not enough perhaps certainly to inform us what the plant was, is yet abundantly sufficient to prove that it was not the chafeyfa, or antirrhinum.

We find the struthion celebrated among the Romans for its virtues; but all the accounts we have of it from them is, that it was a prickly plant, and was very common in the Grecian islands. This, however, is insufficient to convince us of the great error of those who make this plant and the orificeum of the later writers to be the same plant. The orificium is the Smyrnium, or Alexanders, and can by no means be supposed the same species with this prickly plant; yet Macer has made them the same name, and has attributed to the Smyrnium, or Alexanders, the virtues which Theophrastus gives to the struthion.

STRUTHIUM, in the Materia Medica, is used by the modern authors as the basis of the lucern, or dyer’s-weed, a common wild plant with narrow leaves and yellow flowers.

STRUTHIUM is also used by some for the japonaria, or soap-wort. See SAPONARIA.

STRUTT, Joseph, in Biography, an artist and antiquary, the son of a miller at Springfield, in Essex, was born there in 1740, and in 1764 apprenticed to the ingenious but unfortunate engraver, W. Wynn Ryland. In 1770 he became a student at the Royal Academy, where he obtained the gold and silver medals. Connecting antiquities with the practice of engraving, he published, in 1773, a work entitled "The Regal and Ecclesiastical Antiquities of England," containing representations of all the English monarchs from Edward the Confessor to Henry VIII. And of many distinguished personages in their reigns, in their appropriate costumes, taken from illuminated MSS., and annotated with remarkable passages of history. To this succeeded "A Complete View of the Manners, Customs, Arms, Habits, &c. of the English, from the Arrival of the Saxons to the Reign of Henry VIII.," with a short Account of the Britons during the Government of the Romans," in 3 vols. 1774, 1775, 1776, with 157 plates. In 1777 and 1778 he published a "Chronicle of England," designed to extend to six volumes, but discontinued for want of encouragement.
His "Biographical Dictionary of Engravers" next appeared, in 2 vols. 1785, 1786, with 20 plates. His other works are "A complete View of the Dressers and Habits of the People of England from the Establishment of the Saxons in England to the present Time," in 2 vols. 1796, 1799, with 143 plates. "The Sports and Pastimes of the People of England," 1801, with 40 plates. The decline of his health constrained Mr. Strutt to leave the metropolis, and to reside at a farm near Hertford, where he engraved a number of plates for an edition of the "Pilgrim's Progress." His disposition being benevolent and religious, he founded a Sunday school at the neighbouring village of Twain, and devoted much time to reforming the morals of the inhabitants. He afterwards returned to London, where he died in 1802, with an estimable character for moral worth, and for indefatigable industry in elucidating the antiquities of his country. His style of engraving, in which he followed his master, Ryland, was that of dots in imitation of chalk, producing an effect of much softness and harmony. Nicholls's Life. Anec.

STRUYE POINT, in Geography, a cape of Ireland, on the coast of the county of Donegal, a little S. of Inishowen Head.

STRUVIUS, BURCHARD-GOTTHILF, a German jurist and antiquary, son of the preceding, was born at Weimar in 1671, and after a course of education under the most eminent professors at various places, and practicing for some time at the bar, he devoted his time to his favourite studies of public law and history. Upon recovering his health from a state of melancholy, which continued two years, he became librarian at Jena, and afterwards graduated at Hall in philosophy and law; and having fulfilled several offices of service and honour, he died in 1738. His works consist of bibliothecas, biographies, systagmas of history and antiquities, academical disputations, &c. Those that are most known are "Antiquitatum Romanarum Syntagma," 4to. 1701; "Bibliotheca Numismatum Antiquorum," "Biblio.heca Historica felcda," 1705; "Introductio ad Notitiam Rei Literaria," "Syntagma Juris Publici," 4to. 1711; "Syntagma Hist. Germ," 2 vols. fol. 1730; "Historia Mifenfis;" a "History of Germany," in the German language: in all which writings he has displayed profound learning and accurate research. Moreri.

STRUYS BAY, in Geography, a bay on the south coast of Africa: this is merely a large bay, with good anchorage, without shelter, except from north-westerly winds, and exposed to a continued swell and strong current. S. lat. 34° 33'.

STRYBIA, in Ancient Geography, one of the Sporades.

STRHYNOS, in Botany, an ancient name, which occurs in Pliny and Dioscorides, derived from σειρυχων, to overthrow. This appellation was doubtless suggested by the overpowering narcotic qualities of the plant to which it was assigned; στρυχος of the Greeks being a kind of nightshade.


The seeds of this species, well known in our shops as a poison for vermin, by the name of Nuca vomica, are a very potent narcotic, being extremely bitter, and almost fetid. The natives of the East Indies use them in the distillation of intoxicating spirits.—On the continent they are much employed as a medicine, but in this country, where the maxim of physicians is said to be "fatem non nocere," their use is confined to the destruction of noxious animals. The wood is hard and durable. The root is very bitter, and is used to cure intermittent fevers, and the bites of venomous snakes, when that of Naga-nufudie or Lignum colubrium cannot be obtained.

2. S. colubrina. Snake-poison Nut. Linn. Sp. Pl. 271. (Lignum colubrimum; Rumph. Ambin. v. 2. 121. t. 37.)—Leaves ovate, acute. Tendrils simple.—Native also of the East Indies.—From the character given of this species, it may probably be what the Telugus call Naga-nufudie. Indian botanists consider this as a variety of the Nuca vomica. The leaves are opposite, on short stalks, obtuse, lanceolate, three-crefted. Many different sorts of wood are sent to Europe under the name of Lignum colubrum.

3. S. potatorum. Clearing-nut. Linn.Suppl. 148. Roxb. Coromandel. v. 1. 9. t. 5.—Leaves opposite, ovate, acute; mostly five-crefted, veined. Cymae axillary.—Found in the mountainous parts of Madras, flowering during the hot season.—This is rather a large tree, with opposite branches. Leaves very short, on stalks, quite entire, smooth. Stipulas entire, connecting the stalks. Flowers small, yellowish-white, fragrant, in axillary cymes at the termination of the preceding year's shoots. Berry the size of a cherry, dark red, at first tawny-sweet, but afterwards bitter and astringent. The wood is hard and durable, and is used for various economical purposes. The ripe seeds are sold for clearing muddy water, whence the English name.

—Leaves ovate, somewhat pointed, coriaceous, three-nerved; nerves divided. —Native of the tropical part of New Holland, where it was discovered by Mr. Brown, but not in flower.

STREPHONIS, in the *Materia Medica*. See Nux Vomica and *Lignum Calabarium*. The *Faba Sti. Ignatii*, allied to thefe, confitutes the new genus *Ignacia*, which fee.

STREPHONIS, a name given by the ancients to the plant we call *solanum*, or nightshade. (See SOLANUM.) Some of the old authors have all called this *solanum*; and in the times of Theophrastus we find that tithymal and nightshade were fynonymous terms. See *Manicium Strephonis* and *Stramonium*.

STRYCKIUS, SAMUEL, in *Biography*, a German jurif, was born in 1640, at Lentzen, in the marquifate of Brandenburg, studied at Wittemburg, and after travelling in England and the Low Countries, became professor of jurifprudence at Frankfort-on-the-Oder. Having eftablifhed his reputation by his writings, he was appointed prefident of the court of juftices, and elecoral counsellor. Stryckiis occupied feveral posts of highofhonour, and died in 1779, leaving behind him feveral volumes of learned difcourfes on legal fubjects, which were much eftamed.

JOHN SAMUEL, fon of the preceding, was profesfor of law in the university of Hall, of which his father had been director, and acquired reputation by his lecutres and publications. *Moreri*.

STRYE, in *Geography*, a town of Auffrian Poland, in Galicia; 5 miles W. of Halcz.

STRYEN, a town of Brabant; 3 miles S. of Gertrudenburg.—A town, in the ifland of Beyerdland; 8 miles from Dort.

STRYKE. See STRIKE.

STRYMA, or STRYME, in *Ancient Geography*, a commercial town of Thrace, situated near the Litus. It was separated by the lake Ifmania from Maronea.

STRYMALAGA, a town of Indix, on this side of the Ganges, in the number of thofe which were situated between the river Rynuda and the Peafudtomus, according to Ptolemy.

STRYMON, a river which had its fource in mount Hemus, and which formed a boundary between Macedonia and Thrace, before the conquests of the Macedonians had extended the kingdom on this side. At its mouth was the gulf called Strymonicus Sinus.

STRYNKALY, in *Geography*, a little ifland of Denmark, in the Baltic, between Aròe and Langeland. N. lat. 54° 54'. E. long. 10° 36'.

STRYNOE, a little ifland of Denmark, in the Baltic, about 2 miles from the W. coast of Langeland. N. lat. 54° 64'. E. long. 10° 36'.

STRYPE, JOHN, in *Biography*, a voluminous writer of German extraction, was born in the parish of Stepney, near London, in the year 1643, educated at St. Paul's school, and in 1661 entered at Eiufus college, Cambridge, from whence he removed to Catharine-hall. In 1669 he became Master of Arts, and taking orders, was nominated to the perpetual curacy of Theydon-Boys, in Essex, and being afterwards appointed minister of Low Layton, in the fame county, he retained this office during the whole of his life. Having access to the numerous MSS. of Sir Mich. Hickes, fecon-ary to lord Burleigh, he availed himself of them, in his subsequent writings on historical antiquities, to which, probably in confequence of this circumftance, he became zealously attched. His firft publication in this department of literature was entitled "Ecclefialical Memoriaus, relating chiefly to Religion, and the Reformation of it un-der Henry VIII., Edward VI., and Queen Mary I.," in 3 vols. folio, with an appendix to each volume, confifting of original papers, records, &c. The laft of these volumes, which were printed in succeffion, appeared in 1731. The publication of his "Annals of the Reformation of the Church of England," in 4 vols. fol., began in 1701, and were completed in 1731; the laft volume being merely a collec- tion of original papers. His much augmented edition of "Stow's Survey of London" in 2 vols. fol. was published in 1745. The historian, by whom the work was brought down to his own time, and he added maps of all the wards, and illustrative plates, besides various other improvements. In the department of biography, he published separately, in folio volumes, the lives of archbishops Cranmer, Parker, Grindal, and Whitgift, and in three octavo volumes, the lives of sir John Cheke, sir Thomas Smith, and bishop Aylmer. In these works he manifested an indufly and correctnefs, which claimed the repect of prelates and learned perons of his own time, and procured for him feveral small benefices in the church, though he was never advanced to any very limited means which would have been more agreeable to Hackney, where he spent the latter part of a life, prolonged, notwithstanding his unintermitting course of study, to the common age of 94. His death happened in December 1757. Of his works Dr. Birch observes, that "his indufly and fidelity will always give a value to his numerous writings, however deftitute of the graces, and even uniformity, of fyle, and the art of connecting facts." *Biogr. Brit.*

STRZESZYN, in *Geography*, a town of Lithuania, in the palatinate of Mink; 18 miles S. of Róhaczow.

STRZLCE, in *Biography*. See STRZELCE.

STRZOW, a town of Auffrian Poland, in Galicia; 80 miles W. of Lemberg.

STUART, JAMES, in *Biography*, commonly called Athenian Stuart, rofe from an obscure origin, by his talents and indufly, to diftinguished eminence. His father was a native of Scotland, and a mariner of humble station, and his mother a native of Wales. Their fon was born in London in 1713; and his parents, though poor, yet repreffible in character, gave him the best education which their limited means would admit. Being one of four children, left deftitute at their father's death, he was for many years the servant of Hackney, where he spent the latter part of a life, prolonged, notwithstanding his unintermitting course of study, to the common age of 94. His death happened in December 1757. Of his works Dr. Birch observes, that "his indufly and fidelity will always give a value to his numerous writings, however desitute of the graces, and even uniformity, of style, and the art of connecting facts." Biogr. Brit.
visited Venice; and hence they took their course to Pola, in Istria; and when they had examined the interesting remains of antiquity in this place, they returned to Venice. In the beginning of the year 1751 they sailed for Zant, and thence to Corinith, and in the month of March reached Athens. Here they employed themselves, till the latter part of the year 1753, in making drawings and taking measures of the architectural remains to which they had access. At Athens Mr. Stuart became acquainted with Sir Jacob Bouverie and Mr. Dawkins; and the latter, in particular, took pleasure in affording him and his companion patronage and encouragement. From Athens the two artists went to Salonica, where they copied the remains of a fine Corinthian colonnade. Having visited several islands in the Aegean sea, on their way to Smyrna, they returned to England in the beginning of the year 1754. In the year 1762 the first volume of the result of their labours was published under the title of "The Antiquities of Athens measured and delineated, by James Stuart, F.R.S. and S. A. and Nicholas Revett, Painters and Architecs," fol. This work was received with great applause by the lovers of art and antiquity; and though it had been anticipated by the publication of M. Le Roy, which surpassed it in picturesque beauty, yet its superior truth and depth of research gave it a more solid and permanent value. Mr. Stuart, after his return, obtained distinguished patronage in his profession as architect. Lord Anson, who was at the head of the Admiralty, conferred upon him the office of Surveyor of Green-wich Hospital, which he occupied till his death. He was twice married: the first time, at the age of 67 years, to a very young lady, by whom he had four children. The death of one of these, who resembled himself both in mind and body, and who manifested an extraordinary talent for drawing at the age of three years, was followed by a rapid decline of the father's health, who died in 1788, in the 76th year of his age. Two additional volumes of the "Antiquities of Athens" were published after his decease; the second, in 1790, by Mr. Newton; and the third, in 1794, by Mr. Reveley. Gen. Biog.

STUART, GILBERT, LL.D. the son of a professor in the university of Edinburgh, where he was born either in 1742, or in 1743; the date of his birth being uncertain. He was originally intended for the profession of the law; but having acquired reputation, and the degree of LL.D. by an "Historical Dissertation concerning the Antiquity of the British Constitution," he cast his lot among those who are, professedly, writers. With these views he came to London, and for some time contributed to the Monthly Review; but disappointed in his expectations, he returned to Edinburgh in 1774, and commenced a magazine and review bearing the name of that city. Soon after he gained an increase of reputation by publishing "A View of Society in Europe, in its Progrefs from Rudeness to Refinement," of which an enlarged edition in 4to. appeared in 1778. His "Observations concerning the Public Law and Constitution in Scotland" were published in 1779. In this work he introduced a somewhat invidious reflection on Dr. Robertson, characterizing him as being "no where profound;" and indeed he seems to have been jealous of this distinguised historian's literary fame. Dis appointed as candidate for the profefforship of public law in the university of Edinburgh, his feelings were farther irritated; and from that time his leading object appears to have been to set himself in opposition to Robertson, and to deprecate his merits. In 1780 he published "The History of the Establishment of the Reformation of Religion in Scotland," which has been regarded as a spirited and tolerably impartial view of the important events which it details. This was followed, in 1782, by, "The History of Scotland, from the Establishment of the Reformation till the Death of Queen Mary," 3 vols. 4to.

As the rival of Robertson, he enlists himself in this work among the warmest partisans of queen Mary. How far he succeeded in attaining this object, is not our province to determine; but his success was less popular than its opponent; and one of his biographers says, that though "he was not deficient either in acuteness or in diligence, he appears to have been wanting in the moral qualities essential to a writer of history." From this time, and after his removal to London, where he was employed in some periodical publications, his conduct subjected him to ridicule and reproach, and terminated in an incurable illness, under which, after his return to his native country, he sunk in 1786. He poffessed," says the writer of his life already cited, "strong, if not brilliant talents; but his principles were lax, and his temper such as procured him many more enemies than friends." Gen. Biog.

STUART'S ISLAND, an island in the North Pacific ocean, near the W. coast of America, lying in the latitude of 63° 35', and 17 leagues from Cape Denbigh, in the direction of S. 27° W. This island is five or six leagues in circuit; some parts of it are of a middling height, but in general it is low, with some rocks lying off the western part. The coast of the continent is, for the most part, low land, but up the country some part of the land was high. It forms a point opposite the island, which was named Cape Stephens, and lies in lat. 66° 39', and long. 157° 41'. Some drift-wood was seen (see Third Voyage of Capt. Cook) upon the shores both of the island and of the continent; but not a tree was perceived growing upon either. One might anchor, upon occasion, between the north-east side of this island and the continent, in a depth of five fathoms, sheltered from westerly, southwesterly, and easterly winds; but this situation would be wholly exposed to the northerly winds; the land, in that direction, being at too great a distance to afford any security.

STUARTIA, in Botany, received that name from Linnaeus, at the suggestion, as it appears, of Dr. Isaac Lawfon, in honour of the famous John Stuart, 6th earl and then marquis of Bute, who, by his deep and extensive knowledge of this science, and his unbounded devotion to it, merits no common degree to be thus commemorated. His name, thus conferred, will doubtless remain, when others innumerable, unworthily so distinguished, will justly be swept away. Still we cannot converse at the ridiculous supererogation of Koenig, who, ignorant perhaps of the application of Stuartia, established a Butea. See our article Plantæ, where we have hinted that this Butea may, though not on the ground of equal pretension, serve to commemorate, as a lover of plants, the daughter-in-law of the above nobleman. By mistake, Linnaeus and some others have written the above name Stuartia, but we restore the true, and universally well-known orthography.—Linn. Gen. 356. Schreb. 470. Willd. Sp. Pl. v. 3. 340. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 4. 234. Sm. Exot. Bot. v. 2. 101. Pursh 451. Jull. 201. Cavan. Dict. 303. Lamarck Illutr. t. 593. (Malachondron; Mitchell Ephem. Nat. Cur. v. 8. 216. Cavan. Dict. 302. Schreb. 470. Jull. 225. Lamarck Illutr. t. 593.)—Clas and order, Monadelphia Polyandra. Nat. Ord. Ca-namphal. Linn. 8. 104.

five, obturate, concave, spreading, equal, large. Stem. Filaments numerous, thread-felted, shorter than the corollas, disposed in several rows, united at the bottom into a short cylinder, and connected with the claws of the petals; anthers incumbent, of two rounded lobes. Pist. Germin superior, roundish, hairy; styles five, cohering or separate, thread-felted, the length of the flaments; stigmas obtuse. Peric. Capsule superior, ovate, with five furrows, of five cells and five valves, the partitions from the centre of each valve. Seeds one or two in each cell, ovate, smooth, compressed.

Eff. Ch. Calyx in five deep segments. Petals five. Styles five, cohering or separate. Capsule superior, of five cells and five valves. Seeds one or two in each cell, smooth.

1. S. Malachodendron. Common Stuartia. Linn. Sp. Pl. 592. Wild. n. 2. Ait. n. 1. L'Herit. Stirp. 155. t. 73. (Stuartia; Linn. Aet. Upl. ann. 1741. 79. t. 2. Dubam. Arb. v. 2. 283. t. 78. S. virginica; Cavan. Diff. n. 438. t. 159. f. 2. Pursh n. 1. S. marilandica; Andr. Repol. t. 397.)—Petals slightly waved. Styles combined.—Native of swamps in the lower counties of Virginia and Carolina, flowering from July to September. Cultivated by Cateby in England in 1742, but now very rarely seen. It flowered at the mansion of Blandford's in 1804. The stem is shrubby, from five to seven feet high, bulbous, with round, smooth, spreading branches. Leaves alternate, on short stalks, elliptic-oblong, acute, veiny, from two to four inches in length, more or less serrated; smooth, and of a fine green, above; paler, and variously downy, especially about the rib and veins, beneath. Flowers lateral, scarcely axillary, mostly solitary, on short stalks, large and very handsome, with white, concave, wavy, but not jagged or fringed, petals, an inch and a half or two inches long. Segments of the calyx broad and ovate, without any bracts or appendage at the base. Anthers purple. Style united into a cylinder with five furrows, and five short obtuse stigmas.

2. S. pentagona. Curled Stuartia. L'Herit. Stirp. 155. t. 74. Wild. n. 2. Ait. n. 1. Exot. Bot. t. 110. Pursh n. 2. "J. Mill. Ic. t. 5." (Malachodendron ovatum; Cavan. Diff. n. 437. t. 158. f. 2.)—Petals jagged and curled. Styles separate.—On the mountains of Carolina and Georgia, flowering in August. Purf. The precise time of its introduction into the gardens of Britain is not known, this species not having always been clearly distinguished from the foregoing. It was at Kew certainly long before 1785, when we obtained there fine specimens in flower, under the name of S. Malachodendron. Few shrubs are more desirable, yet it is confined to the most choice gardens, being perhaps rather difficult of cultivation, though not very tender as to cold. The stem is five or six feet high, in mode of growth like the last. Leaves deciduous, ovate, acute, variously serrated; smooth above; downy and paler beneath. Flowers axillary, solitary, as large as the former, but of a more greenish-white, or cream-colour, often tinged with red; the margin of their petals deeply jagged, crisped and erose. Calyx with very deep, ovato-lanceolate, hairy segments, accompanied by a pair of lanceolate bracteas, of its own length. Anthers tawny. Germin hairy, deeply five-lobed. Styles quite distinct throughout, a little spreading, smooth. Stigmas recurved, glabrous.

Nothing can be more evident than that these two plants must constitute one natural genus. Indeed their several varieties so nearly approach each other, that the greatest practical botanists have been in the habit of confounding them as one species. Cavallies indeed, an accurate observer, but not accustomed to contemplate the generic characters of plants in a philosophical manner, was decidedly of opinion that these two shrubs must form two distinct genera; for nothing can be more distinct, in theory, than one style and five. L'Heritier judged more correctly, and we have followed his decision. The S. pentagona seems to have taken place of the original Stuartia in our gardens. All that the younger Linæus, the late Mr. Davail, or we know, has at different times had accuracy of the most ingenious English collectors, is the pentagona. A single specimen of S. Malachodendron from Clayton lies in the old Linæus herbarium. This has the styles firmly united, so as to be, in appearance, strictly monogynous. Linæus, not adhering to that circumstance, took the plant for Mitchell's Malachodendron, and hence adopted that name as a specific appellation, which embroils the history of the genus, and might with advantage have been changed by L'Heritier to monogyna.

STUARTIA, in Gardening, a genus which contains a hardy deciduous plant of the North American flowering shrub kind, the species of which is the sturria, or malachodendron (S. malachodendron). It is an elegant shrub, which was introduced here into garden cultivation from Virginia, in the above country.

Method of Culture.—It is capable of being propagated and increased in different ways, as by seeds, layers, and sometimes by cuttings. In the seed method, after the seeds are procured fresh from their native situation, they should be fown, as soon as possible, either in a border of light earth, in an easterly exposure, and covered in to the depth of from about half an inch to an inch; or, where convenient, it would be better and more advantageous to sow them in pots, and to plunge them into a hot-bed of dung or bark, under glases, giving the seeds occasional waterings immediately after being fown, and the young plants when come up, and in their early growth; shading the whole moderately from the effects of the sun, all the while. It is also necessary to be careful in hardening them gradually, in proper time, to the open air, during the summer season; but in the succeeding winter, they should be denuded and kept under a garden-frame, or in a green-house, until the spring, when they should be forwarded as much as possible, by plunging them again into a bark-bed for a month or two, as until towards the approach of the next summer, then gradually again hardening them, and letting them be plunged into the earth of a shady border, until the autumn; at which time they should again be removed under shelter for all the ensuing winter; and in the next early spring they may be potted off separately into small pots, which, if plunged into a bark-bed too, will strike them more expeditiously than where that is not the case; proper waterings and suitable occasional shade being given them; not omitting to harden them as before, continuing to protect them by means of proper shelter for another winter; and in the spring after that, at a time when the weather is settled, they may be ventured to be wholly turned out of the pots, and set out with the balls of earth about their roots, in the full open ground, in not too sunny a situation.

When cultivated by layers, the young shoots should be chosen for the purpose, and be laid down in the early part of the autumn, for the moft part by slit-laying; and in the ensuing spring and summer, in dry times, frequent waterings should be given; and when screenèd by means of moderate shade, in the heat of the summer season, they will root better and more freely, which they sometimes completely effect in the course of one year; when, in the early ensuing spring, they may
may be taken off and potted off separately; when also, if then plunged into any moderately heated hot-bed for a few weeks, they will be forwarded considerably by it; removing them for the whole of the summer to some shady border, and to the shelter of a frame or green-house during the ensuing winter; and in the next spring, they may be set out with balls about their roots into the open ground, where they are to finally remain.

In the cutting method, the cuttings of the young shoots should be planted out in pots of good earth during the spring and summer seasons, and then plunged into a hot-bed, when fame of them will probably strike root, and become proper plants, which are in sufficient time to be transplanted into the open air; and they are afterwards to be managed in the same manner as the seedlings and the layers.

This is a hardy plant, except in the early seedling stage, when it is a little tender, and stands in need of shelter and protection from cold, frosty, winter seasons, as has been seen, until it becomes strong and hardy in the open air; when it will stand coarsely in the open shrubbery quarters without inconvenience.

It affords variety among shrubbery plants, and in collections of the green-house and conservatory kinds.

STUB, in Agriculture, a term signifying the root of a plant, with the top cut off. To stub signifies to grub up the stumps of trees, shrubs, shrubwood, &c.

Stubs, in the Manege, is used for a splinter of fresh-cut under-wood, that goes into a horse’s foot as he runs; and piercing the sole through to the quick, becomes more or less dangerous, according as it sinks more or less into the foot.

Stub-Wood, in Rural Economy, the name of such wood as grows in hedge-rows, and does not properly come under the names of timber, pollards, or thorns, or the young wood that is cut from stubs or fells. It is observed by Mr. Marshall, that the harvesting of this, as of timber, depends on situation, and other circumstances; and that the age or size of cutting must ever be guided by the demand in a given district, whether it be for cord-wood, hop-poles, hoops, flakes, faggot-wood, or other wares; and further, that the mode of disposal is to be determined upon by the succeeding crop. If the land be intended to be appropriated wholly to coppice-woods, it is generally the most eligible way to dispose of the crop as it falls, by one of the modes enumerated for felling timber. But if seedling plants are to be set out for timber stumps, or the young shoots from the stubs to be trained up in the grove manner, it is requisite that a proprietor should employ his own people in reaping the crop, and making it up into such wares as are most saleable and profitable in the particular situations. In regard to the cutting down coppice-woods, the main observances are, to cut them in season, to take off the limbs clean and smooth, with upward strokes of the axe, that the stubs may shoot with the greater certainty; and to cut them off as low as convenience will allow, in order that the shoots may be few and vigorous in their growth.

STUBBEKIOING, in Geography, a town of Denmark, in the island of Falster; 10 miles N.E. of Nyekiisting.

STUBBEN, a small isle on the east side of the gulf of Bothnia. N. lat. 63° 31’; E. long. 22° 51’.

STUBBING, in Agriculture, a term applied to the grubbing up any sort of stub or root, either in woods, hedges, or other places.

STUBBLE, the strawy matter of the cut stalks or stumps of grain, which are left in the field after reaping. The stubble should, in all cases, where it is in any quantity, be collected either for the purpose of thatch or litter. The proper time for cutting over the wheat and rye stubbles is September, when Mr. Young advises their being raked into heaps, for carting home to the farm-yard for litter. The stubble left on the land is not of much advantage as a manure; but carted into the farm-yard, it becomes an excellent manure.

In some parts of Essex, where the wheat stubbles are weedy, they are set fire to in a dry time, and burnt, which is said to be a great destruction to weeds. The bean stubbles, in some places in the same county, when foul, are hand-hoed; and in others they not only hand-hoe them well, but dew-rake and burn the weeds. Some workmen burn stubbles well with a nidget and harrows, by which the weeds are made to rise, and be destroyed by the feed-earth for the next crop. Shimming such stubbles well, too, is often practiced with great success.

Some other modes of managing stubbles, as that of paring them, and others, are likewise in use; but which are mentioned under their proper heads.

STUBBLE-Turnips, a term applied to those sorts of turnip crops, which are grown after the stubbles have been turned down.

The stubbles which have been ploughed after finishing the harvest, and then sown with turnips, come properly round for late spring feed for sheep.

In the Corrected Agricultural Report of the County of Suffolk, it is stated, that about the village of Petworth it is a common practice either to sow stubble-turnips, or rye and tares in mixture, upon the wheat, barley, or oat earth. This admirable practice of throwing in one crop upon the back of another, is thought too good a feature in the management of the district to be passed over without particular notice.

On good dry friable lands, stubble-turnip crops are mostly valuable, and of great utility in the above and other views. See TURNIP.

STUBBLE Break-Plough, a term applied to that sort of ploughing, or paring tool of the spade kind, which is used in some districts in taking off the stubbly surface of lands, in the state of tillage.

STUBBLE Break-Ploughing, a name applied to the unusual and extraordinary practice of paring or having off the surface of lands, in the state of stubble, in some cafes and districts, as Oxfordshire, for the purpose of cleaning them from couch and other weeds, as well as perhaps for some others. The operation is done in a tardy land that is intended for burning; but the depth cut by the workmen is not more than an inch or two at most, which is a singular circumstance, if it have the effect of completely cleaning the ground, which is asserted, and which may be supposed to be the cause; as the farmers would hardly be at such an expense, if the effect did not fully answer their expectations.

The practice might probably be had recourse to in several other districts with great benefit, and be performed in a more ready and cheap manner, by using a harel-plough properly contrived and contructed for the purpose.

STUBBLE-Rakes, the name of a light implement of this kind, contrived with long teeth, sometimes made of iron, used for the purpose of raking up the stubble by the hand.

See Rake.

STUBBLE-ROST, the name of a rake for collecting the stubble together with, which is constructed with wheels, shafts, and a head fet with strong iron teeth, for being employed by means of a horse. It is a very useful and expedient tool for this purpose. See Rake.
STUBBS, George, in Biography, an eminent painter of animals, was born at Liverpool in 1724. He particularly excelled in the knowledge of the anatomy of animals, for which he took great pains in dissection, as well as design. It is unfortunate that the exercise of his talents was confined to portrait animal painting, and particularly of race-horses, as he was capable of much higher productions: witness his picture of Phaeton with the horses of the sun, and those of the horse and lion. His knowledge of the nature and actions of various animals inspired his pictures with peculiar interest. Sometimes his colouring was very good, though never excellent; and he was defective in the execution of backgrounds. His long life was most laboriously and usefully employed. In 1786 he published his Anatomy of the Horse, the most perfect work upon the subject, which he drew, and etched himself, from a natural figure which he dissected for the purpose. He died in 1806, at the age of 82. He was an associate of the Royal Academy.

STUBEN, or STUBNA, in Geography, a town of Hungary, which has some warm baths; and in its vicinity, mines of copper and silver; 6 miles N. of Cremonnitz. Stube, a town of the county of Pluden: 12 miles E. of Pluden.

STUBENBERG, a town of the duchy of Stiria; 9 miles W. of Hardeberg.

STUBENDORF, a town of Silesia, in the principality of Neisse; 3 miles W.S.W. of Ottmachau.

STUBGEN, in Commerce, a liquid measure in many parts of Germany. At Bremen, 45 flugens answer to 38 English gallons. A tonne of beer contains 48 flugens, or 192 quarters. At Hamburg, the ahm is = 40 flugens; and as the ahm contains 10,640 Hamburg cubic inches, or 7300 French ditto, or 883 English ditto, which are 38½ English gallons, 24 flugens are = 23 English gallons. An oxholt (= 574 English gallons) of Bourdeaux or claret wine is reckoned at from 52 to 64 flugens; and a pipe of Spanish wine at from 56 to 100 flugens. A tonne of beer contains 48 flugens, and a small ditto 32 flugens. A quartel of train-oil contains 2 tonnes, or 64 flugens, and is reckoned at 2 centners, or 224 lbs., net weight. See Table XXXII. under Measures.

STUG, in Geography, a town of Bavaria, in the bispohric of Bamberg; 10 miles N.E. of Bamberg.

STUBLANG, a town of Bavaria, in the bispohric of Bamberg; 13 miles N.N.E. of Bamberg.

STUC, or STUCO, in Buildings, a composition of white marble powdered, and mixed with plaster or lime; the whole sifted and wrought up with water; to be used like common plaster.

This is what Pliy means by marmoratum opus, and albarium opus. See Mosaic, &c.

Of this are made statues, busts, baso relieves, and other ornaments of architecture. See Statues.

A flucco for walls, &c. may be formed of the grout or putty, made of good flone-lime, or the lime of cockle-shells, which is better, properly tempered and sufficiently beat, mixed with sharp grit-lane, in a proportion which depends on the strength of the lime: drift-lane is best for this purpose, and it will derive advantage from being dried on an iron plate or kiln, so as not to burn; for thus the mortar would be discoloured. When this is properly compounded, it should be put up in small parcels against walls, or otherwise, to mellow, as the workmen term it; reduced again to a soft putty, or paste, and spread thin on the walls without any undercoat, and well treiwelled. A succeeding coat should be laid on, before the first is quite dry, which will prevent joints of brick-work appearing through it. Much depends upon the workmen giving it sufficient labour, and trewelling it down. If this flucco, when dry, is laid over with boiling linseed oil, it will last a long time, and not be liable, when once hardened, to the accidents to which common flucco is liable.

Liardet's, or, as it is commonly called, Adam's oil-cement, or flucco, is prepared in the following manner: For the first coat, take twenty-one pounds of fine whiting, or oyster-shells, or any other sea-shells calcined, or plaster of Paris, or any calcareous material calcined and pounded, or any aborbent material whatever, proper for the purpose; add white or red lead at pleasure, deducting from the other absorbent materials in proportion to the white or red lead added; to which put four quarts, beer-measure, of oil; and mix them together with a grinding-mill, or any levigating machine: and afterwards mix and beat up the same well with twenty-eight quarts, beer-measure, of any sand or gravel, or of both, mixed and sifted, or of marble or flone pounded, or of brick-dust, or of any kind of metallic or mineral powders, or of any solid material whatever, fit for the purpose.

For the second coat, take sixteen pounds and a half of superfine whiting, or oyster-shells, or any sea-shells calcined, &c. as for the first coat; add sixteen pounds and a half of white or red lead, to which put six quarts and a half of oil, wine-measure, and mix them together as before: afterwards mix and beat up the same well with thirty quarts, wine-measure, of fine sand or gravel sifted, or flone or marble pounded, or pyrites, or any kind of metallic or mineral powder, &c. This composition requires a greater proportion of sand, gravel, or other solides, according to the nature of the work, or the use to which it is to be applied. If it be required to have the composition coloured, add to the above ingredients such a proportion of painter's colours, as will be necessary to give the tint or colour required.

In making the composition, the best lime or hennep, or other oils proper for the purpose, are to be used, boiled or raw, with drying ingredients, as the nature of the work, the season, or the climate requires; and if some cals, beeswax may be subtiliutit in place of oil; all the absorbent and solid materials must be kilned. But the composition is to be of any other colour than white, the lead may be omitted, by taking the full proportion of the other absorbents; and also white or red lead may be subtiliutit alone, instead of any other absorbent material.

The first coat of this composition is to be laid on with a trowel, and floated to an even surface with a rule or darby, (i. e. a handle-flat,) The second coat, after it is laid on with a trowel, when the other is nearly dry, should be worked down and smoothed with floats edged with horn, or any hard smooth substance that does not flain. It may be proper, previously to laying on the composition, to moisten the surface on which it is to be laid by a brush with the same sort of oil and ingredients which pass through the levigating machine, reduced to a more liquid state, in order to make the composition adhere the better. This composition admits of being modelled or cast in moulds, in the same manner as plasterers or statuaries model or cast their flucco work. It also admits of being painted upon, and adorned with landscape, or ornamental, or figure-painting, as well as plain painting. The composition of this flucco, Mr. Liardet obtained a patent in 1773 for fourteen years, the term of which was extended to eighteen years, in consequence of an act of parliament in 1776. For compositions very similar to the preceding, patents were granted.
to Dr. Werk in 1765, Mr. Emerton in 1771, and to Mr. Rawlinson in 1772.

Dr. Shaw informs us in his Travels (p. 296.), that the cement or mortar used in Barbary, which is apparently of the same consistence and composition with those of the ancients, is made in the following manner: They take two parts of wood-ashes, three of lime, and one of fine sand, which, after being well sifted and mixed together, they beat for three days and nights incessantly with wooden mallets, sprinkling them alternately and at proper times with a little oil and water, till they become of a due consistence. This composition, he adds, is chiefly used in their arches, cisterns, and terraces; but the pipes of their aqueducts are joined, by beating tow and lime together with oil only, without any mixture of water. Both these compositions quickly affume the hardnProv. and suffer no water to pervade them: and will, therefore, answer the purpose of flucco.

For other compositions of a like kind, see Mortar, Mortgage for Sun-dials, &c. and Plastering. See also EconoMancy.

STUCIA, in Ancient Geography, a river of Britain, which Mr. Horsey thinks was the mouth of the river Dovi; but both Baxter and Camden imagine it to be Aberlith, or the mouth of the river Ytwh in Cardiganshire.

STICK, in Sail-making, a term used for being fitted.

STUCKAW, or ZUKAW, in Geography, a town of Prussia, in Pomerelia; 16 miles S.S.W. of Danzig.

STUCKUS, John-William, in Biography, a learned divine and philologist, was born in 1542 at the convent of Toessen, in the canton of Zurich; and after a very liberal education, and temporary employment as domestic tutor in a noble family in France, he succeeded, in 1568, to the office of rector in the public school at Zurich; and in 1577 was appointed professor of theology in that city. He died in 1607, having obtained distinguished reputation by various learned works, particularly by his "Scholia on Arrian's Periplus of the Euxine and Erythraean Seas," and "Antiquitatum Convivialium, Lib. IV. in quibus Hebrorum, Crucorum, Romanorum, et aliarum Nationum antiqua Convivorum generae et mores explicantur," fol. Tigur. 1591. Moreri.

STUD, in Rural Economy, the name of the place where fallions and mares are kept to propacage, &c. It further signifies the fallions and breeding mares themselves; also the hormones kept in a stable. See Breeding of Horses, and Mare. See also Stallion.

STUDDING-SAILS, in a Ship, are certain light sails extended in moderate and steady breezes, beyond the skirts of the principal falls, where they appear as wings on the yard-arms: hence some have called them goose-wings. The origin of the name has been variously assigned: some have derived studding from feudal, because the small sails used in cufudding are nearly of the same size and figure with the lower fludding-fails; others have fought its etymology in steddy, because these sails fail the effort of a breeze, and serve to push the ship forward, and to give her head-way; so that, they becomes capable of the power of the helm, and is retained in a steady course: whence studding-fails, afterwards corrupted into studding-fails. Others again derive studding from the Saxen feud, to affish, whence these fails which help the ship's course are called studding, studding, or studding-fails.

The top-mast fludding-fails, or those which are set on the outlde of the top-fails, are spread below by a boom, which fludding out from the extremities of the main and fore-yards, pushes out their lower corners; and their upper edges, which are attached to a light pole, are hoisted up to the top-fail-yard-arms. The lower fludding-fails, which are spread beyond the skirts or leech of the main-fail and fore-fail, are fixed nearly in the same manner; only that the boom, which extends their bottoms, is generally hooked to the chains by means of a gooseneck, or else twines off along with the fail to which it is suspended; being kept steddy behind by a rope called the guy. Falconer.

In the navy lately, an additional fore-top-gallant fludding-fail is to be allowed; and an addition of seven cloths is to be made to one of the fore-fludding-fails, and of two cloths to one of the fore-top-mast fludding-fails: a sail is to be ifued with the latter, to be laced at the bottom, so that it may be hauled out in light winds; and eye-let holes are to be made in the foot of the fail one-third from the tack.

STUDDING-Sail Booms. (See Booms.) In the navy lately, the heels of studding-fail booms are to be reduced from the inner boom-iron, in manner of a top-fail-yard; and a bolt is to be placed at the inner end also.

STUDDING-Sail-Yards. See Yards.

STUDEIN, in Geography, a town of Moravia, in the circle of Iglau; 22 miles N.W. of Iglau.

STUDENullZ, a village and convent of noble Domi- cilians of Germany, in the duchy of Stiiria; 8 miles S.E. of Windisch Grats.

STUDELAND BAY, a bay of the English Channel, a little S. of Poole harbour; deriving its name from a village called "Studland." 6 miles S. of Poole. N. lat. 50° 37' W. long. 1° 28'.

STUFEN, a town of Switzerland, in the canton of Zurich; 9 miles S.E. of Zurich.

STUFF, in Commerce, a general name for all kinds of fabrics of gold, silver, silk, wool, hair, cotton, or thread, manufactured on the loom; of which number are velvets, brocades, mohair, lattins, taffetins, cloths, ferges, &c.

STUFF is particularly used for certain kinds of ftofollen stuffs, used principally for linings, and women's wear, as linseys, ratteens, &c.

STUFF, Bleaching of. See BLEACHING.

STUFF, Cross-grained. See CROSS-GRAINED.

STUFF, Fulling of. See FULLING.

STUFF, in Naval Language, any composition, or melted mass, used to smear or daub the masts, sides, or bottom of a ship. That which is chiefly used for the lower masts is impenetrably, rosin, or varnish of pine: for the top masts, tallow or butter, for the sides, turpentine, varnish of pine, tar, and oil, or tar mixed with oil and red-ochre; and for the bottom, a mixture of tallow, sulphur, and rosin or tar, whase-oil and broken glass, or any part of these ingredients: and this operation is called giving a new coat of stuff to the masts, sides, &c. Falconer. See PAY and SHIP.

STUFF, in Canal, is used for the earth or foil in which they are dug.

STUFFING. See CONSTRUCTION.

STUFFING Drains, in Agriculture, a term applied in some places to the practice of filling them with wood, straw, or other materials, as is the custom in some conduits of surface-draining. See SURFACE-Drain.

STUGEN, in Geography, a town of Sweden, in the province of Jamtland; 25 miles E. of Oterfund.

STUHLINGEN, the capital of a landgrave in Ger- many, belonging to the Furtenberg family; 22 miles N. of Zurich. N. lat. 47° 48'. E. long. 8° 26'.

STUHL-WEISSENBURG, or SERKEZ FEKVERVAR, a royal free town of Hungary, and see of a bishop, situated on mardy
STU

marily ground, occasioned by the river Sarwitz. From this
town run three very large caufeways or moles, among which
are churches, houfes, gardens, and meadows, fo that the in-
habitants of these suburbs are more numerous than thofe of
the town. This was formerly the place where the kings
were crowned, and generally interred; but at prefent its
bief houfes are in ruins, and the town is very much decayed.

The number of inhabitants is estimated at 11,000; 84 miles S.E.
of Vienna. N. lat. 47° 19'. E. long. 17° 50'.

STUHR, a river of Germany, which runs into the
Ochtte, 4 miles N. of Delmenhorft.

STUKELEY, William, in Biography, a physician of
eminenec, and a dilingently antiquified, defended from an
ancient family in Lincolnshire, was born at Holbeach, in that
county, in the year 1687. He received his early education at
the free-school of his native town, and was entered at Benet
college, Cambridge, in 1703; and while an under-graduate,
excited a ftrong propensity to drawing, and to the study of
antiquities. Being intended for the medical profeflion, how-
ever, his principal attention was directed to botany, and the
other collateral fubjefts, which he could pursue at the uni-
versity, until he took the degree of M.B. in 1709. He then
went to London, where he studied anatomy, and acquired a
knowledge of the practice of medicine under Dr. Mead, at
St. Thomas's hospital. He first fettled as a physician at
Bolton, in his native county; but in 1717, he removed to
London. On the recommendation of Dr. Mead, he was
elected a fellow of the Royal Society; and he was one of
the revivers of the Society of Antiquaries in 1718, to which
he acted as secretary for several years. He took the degree
of M.D. at Cambridge in 1710, and in the following year
was admitted a fellow of the College of Physicians in Lon-
don. At this time he published his firft antiquarian effay,
containing a description of "Arthur's Own," and "Gra-
ham's Dyke," in Scotland, with plates. In the year 1722,
being appointed by the College of Physicians to read the
Gulenian lectures, he chose the structure and history of
the Spleen for his fubjeft; and in the following year he pub-
lISHED the substance of his lefions, in one volume, folio,
with plates, under the title of "The Spleen, its Descrip-
tion, Uses, and Diffefes," to which he also subjoined,
"Some Anatomical Observations, made in the Diffefion
of an Elephant." In this work, however, he had not the
credit of much originality; for Haller affirms, that the
plates were copied, without acknowledgment, from Veifius,
and contained several errors. The conceiving of that there
were fome remains of the Elephidian mysteries among the secre-
ts of free-maflory, he became a member of that fraternity,
and was constituted master of a lodge. To this society he
preferred an account of a Roman amphitheatre at Dor-
chester. His propensity to the invefigation of antiquities,
indeed, continued to influence his pursuits; and being
greatly afflicted with the gout, which generally attacked
him during the winter months, he was accustomed to take
various ftrajjes in the spring for the recovery of his health,
which afforded him many opportunities of gratifying his
curiosity. He generally therefore directed his excursions
to thofe places, where the indications of the progress of
Cesar's expedition in this ifland may be traced; and the
collections which he made during these travels, were pub-
lISHED in 1724, in folio, with numerous plates, under the
title of "Itinerarium Curifofum," and a second volume,
containing his description of the Brij, or Cesar's camp at
Piacenas, in 1725.

In the following year, 1726, Dr. Stukeley quitted
London, and settled at Grantham, where he speedily ac-
quired an extensive reputation, and was confulted by the
nobility and principal families in that neighbouring country.
In 1728 he married a lady of good family and fortune.
The fatigues of the profession, however, and the repeated
attacks of gout, which flill harassed him, became at length
too great for his strength, and he determined to enter the
church. He was ordained at Croydon, in 1729, by arch-
bishop Wake; and in the same year was presented, by lord
Delmofor King, to the perpetual benefice of All Saints he Stamford.

About the time of his entering on his parochial currie, in
1730, Dr. Rogers of that place had just invented his orum
arbitrium, which Dr. Stukeley was induced to try, and
having experienced great relief from its use, both in his
own perfon and in others, he was induced to publish an
account of its effects, in a letter to Sir Hans Sloane, in
1753; and in the year following, he printed "A Treatise
on the Caufe and Cure of Gout, from a new Rationale.

Besides fome tracts of minor importance relative to anti-
quities, he published, in 1756, the fifth number of his "Pa-
iegraphia Sacra," or Difcourfes on the Monuments of
Antiquity that relate to Sacred History." In this work,
which he intended to continue, he maintains that the heathen
mythology is derived from facred history, and that the
Bacchus of the poets, for example, is the Jehovah of scrip-
ture, the conductor of the Israelites through the wilderness.

During his residence at Stamford, he arranged his collection
of Greek and Roman coins according to the order of the
inscription history; and from this time his publications were
very numerous.

In 1737 he left his wife, and afterwards married the only
daughter of the learned antiquary, Dr. Gale, dean of York,
and father of his intimate friends Roger and Samuel Gale,
from which period he often spent his winters in London.
In 1740, he published an account of Stonehenge, which
he regarded as a druidical monument. This was followed
by his account of the remains at Abury, in the fame county;
and in these works he incorporated a great part of a
"History of the ancient Celts, particularly the firit habi-
tants of Great Britain," which he had announced as a
separate work. In this "History of Caraffus," in two
volumes 4to, published in 1757 and 1759, he has displayed
much erudition and ingenuity in settling the principal events
of that emperor's government in Britain. He published,
besides, many interesting and valuable tracts, especially
three numbers of "Palieographia Britannica," some papers
refpecling earthquakes, &c. &c. but the left labours of his
life were dedicated to the completion of an elaborate work
on ancient Britifh coins, particularly thofe of Consobrinus,
in which he felicitated himself on having discovered many
new and curious anecdotes relative to the reigns of the
British kings.

Dr. Stukeley was one of the founders of the Egyptian
Society in the year 1741, in which he became acquainted
with the benevolent duke of Montague, who prevailed upon
him, in 1747, to vacate his preferments in the country, and
accept the rectory of St. George's, Queen-square. He
therefore moved his residence again to London, and had a
retirement at Kentish Town. In February 1765, he was feized
with a froke of the palfy, which terminated his valuable
life in the March following, in the 78th year of his age. He
was interred in the church-yard of Erft Ham, in Eilfe, in a
spot which he had chosen when on a visit to the vicar a short
time previous to his death. All his works evidence a pro-
found knowledge of ancient history, tinctured indeed with
that propensity common to his fraternity, of magnifying the
importance of his fubjefts by the allusions of a lively
fancy, and fome credulity. His great proficiency in every
thing connected with druidical history, caused his familiar
friends
friends to designate him as "the Arch-Druick of the age," as an appellation with which he seems to have been flattered; since he concluded a little inscription, which he placed over the door of his retreat at Kentish Town, with words of similar import.

"Me dulcis facture quies,
Obcuro politus loco ;
Leni perfurrar otio
Chyndoaax Druida."


STULP, in Rural Economy, a provincial word, signifying a pot of any kind.

STUM, in Geography, a town of Prussia, in the territory of Marienburg; 6 miles S. of Marienburg. N. lat. 53° 53'. E. long. 18° 52'.

STUM, in the Wine Trade, a term for the unfermented juice of the grape, when it has been several times racked off, and separated from its sediment. The casks are for this purpose well matched, or fumigated with brimstone, every time, to prevent the liquor from fermenting, as it would otherwise readily do, and become wine.

It is this fume of the sulphur from the match that prevents, in this case, all tendency to fermentation, and continues the natural juice of the grape in a sweet state, fit to be readily mixed with wines instead of sugar; for which purpose it is very much used in Holland, and some other countries, as also for giving a new freck, or briskness, to decayed wines. So that very large quantities of this fumus are annually imported to all parts along with the foreign wines; and after the same manner a fumus is prepared in England from the juice of apples which serves the ordinary purposes of the wine-cooper. In preparing this liquor in this state, we see the real use of brimstone, for it could never be done otherwise than by the matching of the casks. Shaw's Lectures, p. 192. See Matching.

STUM, Artificial, an artificial must, or fumus, as good as the natural; and as fit for the re-fermenting, fretting, improving, or making of wines, vintages, and spirits, may be prepared in the following manner:

Take three pounds of fine lump fugar, or such as has been well refined from its treacle; melt it in three quarts of water, and add in the boiling, of Rhenish tartar, finely powdered, half an ounce : this dissolves with a remarkable ebullition, and gives a grateful, acidulity to the liquor: take the vesel from the fire, and suffer it to cool, and you have an artificial must, which in all respects resembles the natural must and sweet juice of a white flavourless grape, when well purified, and racked off from its sediment, in order to make fumus. If this artificial must be flummed, that is, well fumigated with burning brimstone, it becomes a perfect fumus, and may be made of any flavour, at the discretion of the artit. Shaw's Lectures, p. 203. See Must.

STUMBLING, in the Manse, &c. a vice in a horse, either natural or accidental.

The natural arises from the sinews of the fore-legs being somewhat too straight, which cramps the horse, and prevents his using his legs with the necessary freedom and nimbleness. The way to cure him is, to cut him of the cords, i.e. to make a slit on the top of his nose, and with a cornet to raise up the great sinews, to cut them afender, and heal them up again with a proper salve.

The accidental arises from a splint, wind-gall, being foun-
dered, pricked, flubbed, gravelled, &c.

To horse a horse which flumbles is a nice point, as he must be food quite contrary to those which tread only upon the toes of their hind-feet; for his toe must be taken down very much, and also shortened, that he may not meet so easily with impediments and fences upon the roads. This is, however, far from affording any certain relief.

STUMDORF, in Geography, a town of Prussia, in the territory of Marienburg; 6 miles S. of Marienburg.

STUMMING, in Rural Economy, a provincial term, signifying the fuming a cask of cider or other liquor with burning sulphur, which is thus performed. According to Mr. Banker, take a slip of canvas cloth, about twelve inches long and two broad, let it be dipped into melted brimstone; when this match is dry, let it be lighted and suspended from the bung of a cask, in which there are a few gallons of liquor, until it be burnt out: the cask must remain stopped for an hour or more, and then rolled to and fro, to incorporate the fumes of the match with the liquor, after which it may be filled. When stumming is designed only to supress some slight, improper fermentation, the brimstone match is quite sufficient. See CIDRE.

STUMP, a name given to the root part of any solid body, particularly of trees, &c. remaining after the rest are taken away. Where the roots are very large, and obstinately tenacious, it has been advised to blow them up with gunpowder. See BLASTING.

STUMPS. Apple-tree, &c. Grafting upon, in Field Fruit-grounds, the practice of inferring the shoot-iccons of old trees into the stumps of the branches of them which have been properly cut away and prepared for the purpose. When from age, or other causes and circumstances, the heads of these sorts of trees begin to fail and die at the extremities, they are, in some districts of this kind, cut off near the bottom parts of the principal branches or arms, in the stumps of which such ficons are placed by means of crown-grafting. It is remarked, in the Corrected Agricultural Report of the County of Gloucester, that it is not un-
usual to see a fingle stump of fuch trees there bearing eight or ten grafts, and in the whole of a tree from fifty to a hundred. Good new heads are, it is said, formed by this method, where the grafts are not made use of in too great an abundance; and that they come into bearing much sooner than young trees. A flock, from the time of its being grafted, will not probably bear a bushel of apples in twenty years; whereas an old tree, grafted in this way, and properly managed, will bear three times the quantity in half the time; in point of durability, however, it is inferior; and therefore the practice is mostly confined to finge detached trees, and not extended to whole apple fruit-grounds. See Grafting.

STUMP or Stock, Sotching, a term used to signify the fand over which flax and other such materials are broken, beat, and wingleed, in order to render them soft and free from the stem parts in dressing them. It consists of a solid block part at the bottom, with a stem about five feet in height, and a part with a tapering edge upwards at top, over which the substance is held with one hand, while it is stricken or beaten by a properly formed piece of wood held in the other. See Swingle.

STUMPY INLET, in Geography, a channel between two small islands on the coast of North Carolina. N. lat. 34° 24'. W. long. 77° 43'.

STUMSTOWN, a small town of America, in Dauphin county, Pennsylvania, on a branch of Little Swatara, containing a German Lutheran and Calvinist church united, and about 20 houses; 24 miles E.N.E. of Harrisburg.

STUNG, Adder-stung. See ADDER-STUNG.

STUNTED, in Rural Economy, a term signifying fet in the growth; as by bad keep, &c. in animals.

STUPA.
STU

STUPA. See STUPHA.

STUPERFIES, in Medicine, the same as narcotics and opiates.

STUPHA, STUPA, Stupa, sometimes denotes a fomentation.

STUPIA, a name given by some of the writers in chemistry to tin.

STUPKA, in Geography, a town of the duchy of Warsaw, in the palatinate of Lishin.

Stups are numbskulls, occasioned by an accidental bandage that stops the motion of the blood and nervous fluids, or by a decay in the nerves, as in palsy, &c.

STURA, in Ancient Geography, a river of Italy, in Ligonia, which runs perpendicularly into the Orgus, and discharges itself into the Padus towards the N.W., very near Augusta Taurinorum. —Alfo, the name of one of the arms of the Indus.

STURA, in Geography, a sea-port town on the S.W. coast of the island of Negropont. N. lat. 38° 41' E. long. 24° 15'. —Alfo, a river of France, which rises in Mont Cenis, and runs into the Po at Turin.

STURBRIDGE, a township of America, in the S.W. corner of Worcester county, Massachusetts, containing 28,520 acres, bounded by Woodstock and Union on the S. and on the N. by Brookfield; incorporated in 1738, and including 1927 inhabitants. It is famous for its butter and cheese; 22 miles S.W. of Worcester.

STURBRIDGE. See STOURBRIDGE.

STOURBRIDGE, or STOURBRIDGE, the name of a large field or meadow near Cambridge, on the banks of the river Stour, in the parish of Barnwell, celebrated for a fair which is annually held there on the 18th of September, and thirteen following days, under the authority of the university of Cambridge. (See CAMBRIDGE.) Blomfield, in his Colleg. Cantab., remarks, that the name does not arise from a bridge built over the Stour at this place, but from a toll paid at it, for fleers and young cattle. The fair is well attended by trademen from various parts of England; and the different occupations are separately classified in regular streets, or rows of booths, designated by their respective names; as Cook's-row, Bookfeller's-row, &c.; and one division, entitled the Duddery, is allotted to woolen-drapers, mercers, and whole-sale dealers in clothes. Almost every article of wearing apparel and merchandise is here exhibited for sale, and in the evenings the fair is much resorted to by the lower classes, for the purposes of amusement. A court for the prompt administration of justice is always held during the fair, in which the mayor of Cambridge, or his deputy, presides, attended by eight constables, or red-coats, to preserve decorum. The proclamation for this fair is conducted, with great solemnity, by the vice-chancellor, doctors, and proctors, of the university of Cambridge, and the mayor and aldermen of the town, dreased in their official habits. At a short distance S.E. of Stourbridge stands an ancient stone chapel, which now serves as a repository for the relics of the fair.—Beauties of England and Wales, vol. xi. by J. Britton and E. W. Brayley.

STURDY, a disease in sheep, which is of much importance, equally on account of its frequent occurrence, and because it constantly terminates fatally, unless relieved by art.

There are two varieties of it, as stated by Dr. Duncan, junior, in his useful paper on it, in the third volume of the Transactions of the Highland Society of Scotland; the appearances in each of which are as follow. When a sheep is attacked with the first of these varieties of the fury disease, it ceases, it is said, to improve, becomes dull, is apt to loiter behind, and separates from the flock. It does not walk straight forward, but often deflects on one side, or dozes round in a circle. The eyes glare feebly in its head, and seem enlarged, from the pupil being round instead of oval, which in healthy sheep is always the case in the day-time. Its vition is impaired, and it does not see any object which approaches it, until it be very near, when it flirts away, and runs furiously, without any aim. When caught, it is remarkably stupid on being again liberated. In dry weather, it follows eagerly to that quarter from which the wind blows. It has a great reluctance at passing water, as burns or brooks, and cannot easily get through them, but mostly frequents places where it can hear the sound of water. Some time after these appearances have prevailed themselves, in the course of perhaps about three weeks, there appears and is found, on examining the head, by preying on it with the thumbs, a remarkable degree of loftiness at one part of it, where the skull seems to be wanting. But in a few inflexions, no loftiness is to be discovered in any period of the disease, but in either case, if not relieved by a proper operation, the animal loses the power of standing, and dies perfectly emaciated. The continuance of this sort or variety of the disease extends or lasts from two months to a year, as the circumstances of the particular case may be.

The second or latter of these varieties is, however, much more rapid in its progress, in which, in addition to some of the above appearances, a great degree of stupor comes on in a few days, which is followed by total blindness, and no loftiness is ever to be found in any part of the skull or bones of the head.

The appearances on opening the head in the first of the above varieties, are an oval or round bag, which is found lying between the brain and the skull, quite unconnected with any of the surrounding parts, generally situated between or beneath the horns. These bags vary much in size, being sometimes no larger than a plum, while at others they are as big as a goose's egg. They are filled with a clear fluid, like water, sometimes intermixed with a thin crust, when it is of a glutinous or slimy nature. Within, or in the skins of these bags, are seen, according to fome, many little white bodies, nits, or the ova of insects. These are thus described by Mr. W. Hog, which, though in some measure hypothetical, display an accuracy of observation. He is induced to believe, from two or three recent cases and observations, that the dissolution of the brain, &c. is occasioned by numbers of animalcula, which have been noticed to be swimming loosely in the liquor. They resemble ants' eggs, both in shape and colour, but are somewhat shorter. However, as all the animals upon which he made the observation had been dead for some time, so these pus inhabited hair of the brain were also dead; but if they had been living and organized animals, which he has no doubt they were, there would be multitudes of so diminutive a size, as to be quite imperceptible to the naked eye; and he is fully convinced, that if the disease was minutely observed in all its stages by microscopical examination, whatever its beginning was, its progress would be, by the activity of these animalcula, increasing both in number and size.

However, in proportion as the disease advances, the bag increases in size, and by its protrusion causes the brain to decrease, while the skull immediately over the bag becomes soft and disappears, so that nothing intervenes between it and the integuments of the head. Sometimes, but only in those cases where no attempt has been made to cure or remove it, there are many small bags, unconnected with each other, distributed through the brain or cerebral parts.

In the form or variety of the disease, the water is not con-
contained in a bag, but within the substance of the brain, in certain cavities termed its ventricles, and sometimes in the hinder parts, where it joins with the spinal marrow, in which case it is thought to be quite incurable.

Hard substances or excrescences growing out from the inside of the skull, and blows upon the head, occasionally produce all the appearances of real sturdy; but in these cases, no water is to be found in the parts.

The cause of the appearances in this disease is therefore, unquestionably, prelude on the brain, whether it arise from accidental contusion, from a bone excrescence, as in falfe sturdy, or from a collection of water, as in the legitimate varieties of it, as seen above. What, however, gives rise to these collections of water, is not by any means so well ascertained. Inflammation of the brain probably precedes its effusion in the latter variety of the disease; but the generation of the hydatids, or water-bags in the former fort or variety, is not at all understood. The disease is not contagious; neither is it peculiar to any foil. It generally affects sheep of the hog kind in the beginning months of the spring and summer, and is commonly ascribed to copulation, to tempestuous weather, without sufficient shelter.

In regard to the cure of the disease, as the natural termination of it is invariably fatal, unless those rare recoveries which are sometimes the consequence of accidental blows on the head, that probably rupture the bags, be excepted; and more especially as the mutton in this disease is good, the sooner an attempt is made to relieve the animal by the proper operation, the better; for want of which relief, although it is extremely fitful, and not unfrequently successful, thousands of sheep are suffered to perish through carelessness or ignorance. The Cure in these cases may be attempted in three different ways; as by tapping, trepanning, and wiring. Where the bag is seated any where in the crown of the head, some suppose that the most ready and the gentlest method is to tap it in the place where the skull is soft, and to let the water run out. This is most commonly performed by means of an awl, or large corking pin, though an instrument with a small tube in it, termed a trocar in surgery, might be easily contrived and formed, which would drain it off in a more complete manner. By this operation, if the instrument be not pushed too far, the animal is nothing the worse, it is said, whether it recover or not. But what is very remarkable, this plan is not, it is said, successful on all farms alike, of which many instances are known. An old shepherd has often been heard to remark, that in the course of thirty years' experience, not one sheep out of twenty which he had tapped on his own farm had died, while it was very rare that he could cure any one of the neighbouring ones. He constantly performs it with a corking pin. Others affect, that in their neighbourhoods, more sheep have been cured by this operation than by any other, in performing which, the sheep is advised to be laid on its back, and the pin to be inserted in an oblique manner; if water follow, the cure is said to be certain; but even though it should not follow, provided the bag be pricked into, it is often successful in removing the disease.

In the mode of cure by means of trepanning and extracting the bag or cyst, the description of which is accurately given below, there are several circumstances to be carefully attended to.

The animal being properly secured, and the head placed in the most convenient position, the part to be cut being uppermost, the skin is to be divided by an incision an inch and a half in length, crossed by another of the same length at right angles to it. The skull, which is quite soft, is then to be cautiously divided in the same manner, until the bag with the fluid in it appear clear at the bottom of the incision, which it commonly does. The soft skull is now to be turned back, or a bit cut out of it, so as to render the bag completely evident. It should then be taken hold of by a pair of blunt forceps, and be gently moved backwards and forwards, to loosen it from its connections, which are generally very slender. This may also be done by means of a crow's-quill, or any blunt-pointed instrument, carried frequently round it. The nose of the animal is now to be held, so as to restrain its breath, which may force the bag from its situation. The operator is to continue moving and pulling it, flopping the breathing of the sheep at intervals, until it is quite extracted. The skin after this is to be laid neatly down again, and a cloth spread with tar placed and tied over the wound above the dry lint, which is folded and laid on it, to prevent either cold in the spring, or flies in the summer from injuring it. This is to be allowed to remain for two days, when the dressings may be changed, and a bit of cloth spread with hog's-lard, fresh butter, tar, or some other ointment, applied on the wound. The dressings should be changed every second day, for ten days or a fortnight, after which time, in ordinary cases, it will require no more attention, being generally healed up. The skull grows over it in about a month, and then becomes of its usual hardness; and the animal is equally healthy, as if no disease had previously existed.

It is said that the fenes return after the operation in a few hours, and that the next day the sheep seems to be quite relieved.

When, in consequence of rashness or inattention, the bag containing the fluid has been ruptured, which sometimes happens, it is very difficult, and in many cases impossible, to extract the sac. The best practice, in this situation of things, is, it is said, to place the animal in such a position, as that all the fluid may run out and be, discharged; washing the wound with spirits, and trying to extract, if possible, the remains of the sac, then drenching it with a mixture of tar and balsam, or either separately, then turn the animal, which has now lost its stupid appearance, into a good pasture. The damps and cold of nights should be avoided, as they tend to produce inflammation, which very soon destroys the animal. In this case, the admission of the external air, and the irritating dressings, cause the sides of the sac to adhere; this, however, is not always the case, it is said; as after a week or two, the appearances of the disease have been known to return, after the alleviation which the operation constantly produced. When this happens, it is almost impossible to extract the bladder or bag entire, on account of the inflammation, from the cutting causing strong adhesion. In this case the bag may be opened, and a little spirits or port wine injected by means of a syringe, which has been known, in more than one case, to prevent a return of the symptoms. This operation should not, where possible, be performed in hot or very warm weather, as maggots are extremely apt to breed in the wound. In frost, too, inflammation is liable to be produced, which may also at that time render it improper. In these cases, the sheep should be fattened for the butcher as soon as possible.

In respect to the operation of wiring, it is described in this manner by Mr. J. Hog. In case the skull should feel soft in the forehead, then the operation must be performed by thrashing a stiff sharpened wire up each nostril, until it flops against the upper part of the skull. If this mode of cure were not well authenticated by daily experience and observation, it might, it is said, appear a very severe and dangerous operation or practice, as the wire goes quite through...
through the brain in two different places; yet a far greater number of sheep are cured in this way than by any other. The above person has cured many both ways, he says, and killed a part too; but those which he killed were generally with the wire, because, if the other fail of producing the defined effect, the wire is constantly applied to as a last resource; and many have been seen cured by it which were apparently past all means of recovery.

By some of these means, properly made use of, this disease will be found to be mostly capable of being effectually removed.

**STURGEON** (Acipenser fluvo) of Linnaeus, in Ichthyology, a very well-known, large, and fine-tasted fish, caught in many places, and sometimes in the river Thames, being one of those fishes called anadromi by authors, which spend a part of their time in the sea, and a part in rivers.

It never goes into the sea to any great distance, and is never caught there of any very great size. The fish serves for its production; but it is only in large rivers that it grows to its usual size. It is found in the main ocean, in the Mediterranean, Red, Black, and Caspian seas, whence it ascends the rivers connected with them in April and May, to deposit its spawn, which is very abundant.

This fish is admired for the delicacy and firmness of its flesh, which is as white as veal, and extremely good when roasted. It is generally pickled. The sturgeon which we receive comes either from the Baltic rivers, or North America. Those cured at Pillau are reckoned the best, though of late they are rivalled by those brought from America, in the rivers of which country they abound in May, June, and July; at which time they leap some yards out of the water, and, falling on their sides, make a noise to be heard in still weather at some miles distance.

The sturgeon grows to a great size, to the length of eighteen feet, and to the weight of five hundred pounds; but in our rivers it is seldom taken of that bulk; the nose is long, slender, and pointed; the eyes very small, with the nostrils near them; in the lower part of the nose are four cirri; the mouth is placed far beneath, is small, without teeth, and unsupported by any jaw-bones, so that the mouth of a dead fish is always open, but when alive, closed or opened at pleasure by certain muscles; the body is long, pentagonal, and covered with five rows of large bony tubercles; the whole under-side of the fish is flat; on the back, near the tail, is a single fin; and it has also two pectoral fins, two ventral, and one anal fin; the tail is bifurcated, the upper part being much longer than the other; the upper part of the body is of a dirty olive-colour, the lower part tawny; the middle of the tubercles white.

This fish, in the manner of its breeding, is an exception among the cartilaginous fish, being like the bony oviparous, spawning in winter. Cavear is made of the roes, and ichthyocolles of the found of the sturgeon. (Ray and Pennant.) The variety called by Pliny and others Attilius, Adella, Adano, and Adalus, and the Rhodius of Rondeletius, is found in the Po, and also in smaller rivers and lakes. It was held in high estimation by the Romans.

The other species of *Acipenser* are the following: the *A. rubens*, or herlet, with a straitly fabulate finot, cirri near the mouth, and entire lips. It is found in the Caspian sea, and in the rivers connected with it, rarely in the Baltic, and also in the lake Mejer and Pomerania. The *A. bufo* is described under Huso. The *A. schyla* has an obtuse snout and cirri near its apex, with bird lips. It is found in the Caspian sea, and in the lake Oka of Siberia. Some have doubted whether this be a distinct species from the *A. furio* or not. The *A. feletus*, or kolter, has a spatulate somewhat recurved snout, with its cirri near the mouth, and entire lips. It is found in the Caspian sea, from which, in the beginning of May, it ascends in large shoals into the rivers; and it is also common in the Danube. It is very fertile, inasmuch that the female yields more than 300,000 eggs. Sturgeon is reckoned one of the royal fishes.

**STURGEON BANK**, in Geography, a shoal in the gulf of Georgia, extending from Point Roberts to Point Grey.

**STURGEON LAKE**, a lake of North America, on whose east bank is situated Cumberland House, in N. lat. 53° 56', and W. long. 102° 15'. The distance between the entrance of the lake and Cumberland House, is estimated at twenty miles. The mud which is carried down by the Saktchewine river, has evidently formed the land that lies between it and the lake, for the distance of twenty miles in the line of the river, which is inundated during one-half of the summer, though covered with wood. This lake forms an irregular horse-shoe, one side of which runs to the N.W., and bears the name of Pine-island lake; and the other, known by the name already mentioned, runs to the N.E. of it; and is the largest; its length being about twenty-seven miles, and its greatest breadth about six miles. In N. lat. 54° 16', the Sturgeon-weir river discharges itself into this lake, and its land appears to be almost the famed island of rock that forms the N. side of the lake, and also the W. shore of the lake Wimpie, and is almost a continual rapid. Its direct course is about W. by N., and with its windings, it is about thirty miles. It takes its waters into the Beaver lake.

**STURGEON LAKE**, also a lake of North America, N.E. of lake Superior, in N. lat. 49° 35', and W. long. 92°.

**STURGEON CREEK**. See KITTY.

**STURGEON RIVER**, a river of Canada, which runs into lake Huron, N. lat. 44° 51', W. long. 81°.

**STURM**, in Ancient Geography, one of the Sthedeschec.

**STURK**, See STIRK.

**STURKS**, in Rural Economy, a term applied to yearling cattle.

**STURLESON, SNORRO, in Biography**, a celebrated Icelandic writer, styled the Herodotus of the North, was born in the diocese of Dale, in the year 1178. As three years of age he was put to school under the learned John Loftson, a distinguished character at that period, whom he remained till the time of his death, in 1197. Though of noble descent he was poor, till by marriage he so much increased his property, as to become the richest man in the island, excepting the son of his deceased preceptor. He was remarkably fond of parade; and when he went to the courts of justice, was usually attended with several hundred armed men. He possessed fix large farms, and several on a smaller scale. After the death of his father-in-law, in 1202, he removed to Borg, the inheritance of his wife; but in 1209 he went to reside at the farm of Reikhol, in the improvements of which he spared neither time nor expense. He surrounded his manor and church with a very high rampart, to serve as a security in time of danger; and by means of a subterraneous channel, constructed of stone, conveyed water from the neighbouring warm springs of Skríska, to a bath, still denominated after the founder, Snorrolaug, which was paved with hewn stone, and bordered by leats of the same material. This building has survived the depredations of 600 years. In 1213, Snorro was chosen supreme judge over the whole island. About the same period he acquired great reputation abroad by his poetical talents. He composed a poem in honour of the powerful northern earl, Haco Galin, which he sent to him.
the same year from Iceland, and in return for the civil liberty he received many valuable presents. In 1218 he proceeded to Norway, where he was in great favour with the king, Hacon, and several of the nobility. Under the government of this sovereign, he was appointed to various offices, and went several times to Iceland, in order to promote his patron's views in regard to that island. It having been determined to send troops thither from Norway, either for the purpose of conquering the country, or for obtaining satisfaction on account of some acts of violence committed by the inhabitants against Norwegian merchants, Snorro presided over this expedition, by his remonstrances to one of the king's friends; but he engaged, on the other hand, with the assistance of his brother, to bring the island under the king's authority without bloodshed, and promised to send his son to Norway, as a pledge of what he had undertaken. When Snorro set out on this mission, he received, besides other presents, a ship completely equipped. Having returned to Iceland in 1237, nothing farther was done: either Snorro found it impossible to carry his designs into execution, in consequence of disturbances which agitated the island, and in which he himself had a share, or he was wounded, through a view to private advantage, to deceive both the king and his own countrymen. He was at enmity with his relations, among whom were his brother, his nephew, and his three sons-in-law, who had all repudiated their wives. Finding himself too weak to contend with his numerous enemies, he quitted Iceland in 1237, and went again to Norway, where he arrived at the moment when Duke Skule was preparing to deprive his sons-in-law, King Haco, of the crown, and to place himself on the throne in his stead. Snorro deplored the party of the duke, but returned to Iceland in the company of Thorvaldur, a relation of King Haco, by whom he had been raised to the rank of earl; one of Snorro's sons-in-law, but had now become his bitter enemy. In 1240, King Haco sent him a message, after he had got rid of Duke Skule, either to bring Snorro a prisoner to Norway, or to put him to death. At first, Gifur intended to execute his murderous designs at the place where justice, as it was called, was usually administered; but finding this inconvenient, he fell upon him at his residence, where he was assassinated, in the 65th year of his age. Snorro was universally a great and learned man; his "Heimskringla, or Chronicle of the Norwegian Kings," has been printed at various times, and under different forms. A Danish translation of it by Claesen, with Worm's preface, was published at Copenhagen in 1633 and 1637. It was printed at Stockholm in Icelandic, Swedish, and Latin, in 1697, 2 vols. fol. But the most elegant edition is that that of Schöning, published in Icelandic, Danish, and Latin, which was printed at Copenhagen in 1777 and 1783. This was printed at the expense of the crown-prince; the Latin translation and notes were by Schöning; but the Danish is that of Claesen, revised by J. Olausen. By this important work, which throws so much light on the earliest history of Norway, Snorro rendered much service to posterity. But his merit does not rest on this alone, since he is commonly considered as the author of the prose Edda, edited by Rekenius in 1665, which is founded on those old poems said to have been collected by Sæmund, and on that account called "Edda Semundii." The Edda of Snorro is a poetic manual, or sort of Scandinavian art of poetry, consisting of three parts. In the first part, which may be compared to Ovid's Metamorphoses, or Hesiod's Theogony, are related all those fables contained in the works of Skaldas. The second part is a treatise on poetical philology or synonymy, which shews in what manner the Skaldas gave names to different things; and the third, called Skaldas, treats of alphabetical characters, their division, and the relation they bear to musical tones; of poetical licences, metre, &c. The last part has never been published. Notwithstanding the general merit of Snorro, he is described as a cunning and deceitful man; unsteady in his friendship, fond of money, as well as ambitious, and of a violent and quarrelsome disposition. Gen. Biog. STURLITZ, in Geography, a town of Prussia; 18 miles S.W. of Novi. STURM, JAMES, in Biography, was born of a family of eminence at Strasbourg, in 1489, and emigrated at the age of twenty-five into the lenity of his native place. He was an active promoter of the Reformation, and deputed to the imperial diet, assembled on that occasion. When the deputies of the reformed were excluded, in 1529, from the diet at Spire, Sturmius boldly entered his protest against the measure, and on behalf of his confederates and the other confederates, declared, that if good citizens were thus divorced of their privileges, contrary to the customs of the empire, it could not be expected that they should contribute to the public expenses. His protestation on this point gave rise to the appearance of "Protestants." Amongst other offices of important trust, which were committed to him, he was one of the ambassadors sent in 1536 from the states of Germany to Henry VIII. of England. By his influence a college was established at Strasbourg in 1538, and at his death he left to its support a considerable legacy. Seiden, in his "History of the Reformation," avails himself of much valuable information communicated by Sturmius, of whom it is recorded, that being scandalized by the violent disputes among the Reformers concerning the Lord's Supper, he abstained from many years from receiving it. After having several times served his state as mayor, and having been ninety-one years delegated from it on public business, he died in high esteem, at the age of sixty-four. Gen. Biog. STURM, JOHN, was born at Stilea, near Cologne, in 1507, and studied at Liege and Louvain, in which last city he set up a press, and joined Reclus, the Greek professor, in printing several Greek books. In 1528 he transferred his printing-press to Paris, where he delivered lectures on the age marriage, and on logic, and wrote his "Heimskringla, or Chronicle of the Norwegian Kings," which has been printed at various times, and under different forms. A Danish translation of it by Claesen, with Worm's preface, was published at Copenhagen in 1633 and 1637. It was printed at Stockholm in Icelandic, Swedish, and Latin, in 1697, 2 vols. fol. But the most elegant edition is that of Schöning, published in Icelandic, Danish, and Latin, which was printed at Copenhagen in 1777 and 1783. This was printed at the expense of the crown-prince; the Latin translation and notes were by Schöning; but the Danish is that of Claesen, revised by J. Olausen. By this important work, which throws so much light on the earliest history of Norway, Snorro rendered much service to posterity. But his merit does not rest on this alone, since he is commonly considered as the author of the prose Edda, edited by Rekenius in 1665, which is founded on those old poems said to have been collected by Sæmund, and on that account called "Edda Semundii." The Edda of Snorro is a poetic manual, or sort of Scandinavian art of poetry, consisting of three parts. 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STURMUS, the Stars, or Staring, in Ornithology, a genus of birds of the order Passeres, of which the generic character is as follows: Bill fulvate, angular, depressed, bluntish; the upper mandible is entire, somewhat open at the edges; the nostrils are surrounded with a prominent rim; tongue notched and pointed. There are seventeen species.

*VULGARIS*; Common Staring. Bill yellowish; body black, with white dots. This is very common in our own country, and is found in other parts of Europe, Asia, and America. It is about nine inches long, and builds its nest in the hollows of trees, caves of houses, towers, or rocky cliffs; it lays from four to five eggs, which are of a pale-fish-green colour. In the winter season, starlings assemble in vast flocks in marshy places; feed on worms and insects; are very docile, and may easily be taught to speak. The flesh is bitter, and scarcely edible. The other characteristics of this species are, that their quill-feathers and tail are of a dullish hue; the former are edged with yellow on the outer side, the latter with a dirty-green; lesser coverts edged with yellow, and slightly glossed with green; the legs are of a reddish-brown. Male is shining, with purple, green, and gold.

During the winter months, starlings crowd together in such close and well-arranged battalions, that no bird of prey dare to penetrate their ranks. This manner of flight, which is extremely useful in defending them against rapacious birds, renders them a more easy prey to the wiles of the bird-catcher, who dispatches among them a number of birds of their own kind, each having a glued thread tied to its leg, by which some of them are entangled and brought to the ground. Their love of society not only prompts them to associate with birds of their own species, but with others in no way allied to their tribe. In the spring and summer they are frequently seen with crows and crows, and even with pigeons. It is, however, principally towards night that the starlings unite in large companies, as if to put themselves in sufficient force to brave its dangers. Then they assemble in a flock, and after various evolutions, rush with such impetuosity into the midst of the trees, and spend the evening in chattering, till darkness puts an end to their conversation.

In the morning, at day-break, the noisy conference is resumed, till they depart or separate in search of food. Starlings seldom take the trouble of building nests for themselves, but generally take possession of the deserted abodes of some other birds.

Their docility, and the beauty of their plumage, have rendered starlings great favourites. They are frequently taught to speak, and sing long-tunes. Their vocal powers are, however, acquired by education, and in the domesticated, they support a musical character much better than in the wild.

There is in the productions of Nature a continual tendency to variety, which is clearly exemplified in most of the tribes of birds, and which the diffus, and almost inflating characteristics of the starling, have not been able to defeat. Hence naturalists have enumerated five varieties of the common starling; of which the first independently of that already described has a white body; the second is white; the crown, neck, wings, and tail, are black; the third is white, but above the eyes and near the bill are two black spots; and the fourth is cinereous, with black bill and legs.

*CAPENSIS*; Cape Starling. Blackish beneath; the sides of the head are white. It inhabits the Cape of Good Hope, and is the size of the last. The black and the white, which

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STURMINSTER, or STURMINSTER-NEWTON, in Dorset, is a small market-town in the hundred of Sturminster Newton-Castle, in the Sherborne division of the county of Dorset, England. It is situated eight miles S.W. from Shaftesbury, and 111 miles W.S.W. from London; and is divided into two parts, viz. Sturminster, which lies on the north side of the river Stour, and Newton or Newton-Castle on the south. The latter is a small hamlet, and a divided thingy. Sturminster and Newton seem sometimes to be synonymous names for the same vill; but Newton is often the general name in ancient records, perhaps on account of the manor-house, the occasional residence of the abbots of Glastonbury, being built by the latter. Both these villages consist of one manor, and are joined together by a causeway, and a bridge of five arches over the Stour. Sturminster, if not of Roman origin, was known in the early ages of the Saxons. The ruins of an ancient castle stand on a hill, and are surrounded by a high vallum, and deep ditch, on the south-west and part of the east; near the centre is a small artificial mount, or keep. The manor was held by the abbey of Glastonbury, by a grant from king Edgar; having been formerly bequeathed by Alfred to his son Eadward. Edmund Ironside confirmed this grant in 1016, when it contained seventeen hides. After the dissolution, Henry VIII. gave the manor, rectorcy, and vicarage, to his queen, Catharine Parr. On her death, Edward VI. granted the estate to his sister, Elizabeth, who, when she came to the crown, gave it to Christopher Hatton: after having many intermediate possessors, it finally passed to the noble family of Rivers, in which it still continues. This town, according to the population return of the year 1811, contained 352 houses, and 1451 inhabitants. Two fairs are held annually, and a weekly market on Thursday.

On a lofty eminence, called Hambledon-hill, standing in the parishes of Child Ockford, Shrotton, and Hambledon, are considerable remains of an extensive fortification. Bishop Gibson supposed this camp to have been formed by the Danes; but Aubrey informed that Roman coins had been plopped up on the top of the hill. The eminence is divided by a deep and narrow vale from another, called Hod Hill, situated partly in the parish of Stour-Paine, and partly in the town of the same name, in the form of a Roman D.—Hutchins's History of Dorsetshire, vol. 2. Beauties of England and Wales, vol. iv. by J. Britton and E.W. Brayley.

STURHNOSEN, a town of Prussia, in the province of Pomerania; 17 miles E. of Heilberg.
which are the only colours of this bird, are distributed very like to those of our pies. The bill is thicker and longer than that of the European Starling, and its distinguishing marks are two large white spots of a round form on each side of the head. In the middle of these are placed the two ears.

**Ludovicianus**; Louisiana Starling. The specific characters of these are, that they are spotted with grey and brown, beneath they are yellow; the head and eye-brows are marked with a white line; the chin is black. A variety is variegated with brown, reddish, and blackish, beneath yellow; with a curved black band; the three lateral tail-feathers are white. The starlings of Louisiana are observed in great flocks in the interior regions of North America. By their manner of flight, as well as their shape, they indicate a near approach to our European kinds. The lower parts of the body are yellow, the upper brownish-grey; and they are distinguished by a large dark-coloured spot upon the breast. The American starlings are inferior to those of Europe in the powers of song; they are from nine to eleven inches long; their bill is white, terti with brown; the cheeks are yellow; the wings and tail are of a reddish-grey; the legs also are grey.

**Contraria**; Indian Starling. *Brown*; eye-spot, bar on the wings, and belly, white. It inhabits India, and is thought to be a variety of the *S. canus*. The body of this species is blackish; the rump on the upper part of the neck white; the upper wing-coverts are marked with white spots; the legs are of a pale yellow.

**Cicinnus**; Water-Ouse; Crane. Black, with a white breast. This species is common to our own country, other parts of Europe, and northern Persia. It is about seven or eight inches long; frequents waters, and feeds on aquatic insects and small fish; it is a very solitary bird, and breeds in the holes of banks; makes a curious nest of hay and fibres of roots, lined with dead leaves, and having an entrance of green moss. The chin is white; the tail black; belly ferruginous; in the young bird it is white; the legs are of a pale blue before, and black behind.

**Miliaria**; Magellanic Starling. Grey; breast and chin red. It inhabits the Falkland islands, and is eleven and a half inches long. Behind and under the eyes is a white spot; the lores are red; on each side the neck is a black blotch; the vent and sub-forked tail are black.

**Moritanus**. Cinerous; lower part of the head and chin varied with cinereous and white; belly spotted with reddish hoary; the bill is terti with black. This species inhabits the alpine parts of Persia; it is the size of a common lark, builds in hollow rocks, and feeds on insects.

**Lytca**. Spotted with brown and white, chin and breast scarlet. It inhabits Chili, and is larger than *S. vulgaris*; it builds in holes on the ground, and lays three cinereous eggs, varied with brown; it sings well, and is easily tamed.

**Mexicanus**; Mexican Starling. Blue varied with black. It inhabits South America, and is about the size of the *S. vulgaris*. The bill and eyes are black; irides yellow; the head is small.

**Obscurus**; Brown-headed Starling. Black, but the head is brown, whence its trivial name. It inhabits New Spain.

**Zeylanicus**; Ceylonese Starling. Line over the eyes and one on the sides of the head black; body grey, varied with ochre and white spots and crescents; quill-feathers green; tail marked with green and black lines. It inhabits Ceylon, and imitates the notes of other birds. The bill is black, the head yellowish; the legs are of a blueish-grey.

**Stuc**

**Fuscus**; Brown Starling. *Olive*; eye-band blueish; bill and legs reddish. This is found chiefly in China. The belly is yellowish; the tail long.

**Viridis**; Green Starling. Green, beneath blueish; a tuft of black and white feathers on the front and chin. This inhabits China. Above the front, and behind the eyes, a white spot, and two on the shoulders: quill-feathers and shafts of the tail-feathers white, legs blueish.

**Saniculus**; Silk Starling. Pale-grey; wings and tail black, the former with a transverse white bar; head ochre-yellow. It inhabits China, and is the size of the *S. vulgaris*. Bill and legs orange or red; the plumage is silky.

**Carunculatus**. Bill and legs black; at each angle of the mouth a pendent orange wattles. It inhabits New Zealand, and is ten inches long. The female is of a rufous-brown, with very small wattles. The male is black; the back and wing-coverts ferruginous.

**Collaris**; Collared Starling. Blackish-brown, spotted with brown; the flanks are rufous, the chin is white spotted with brown. This species is found chiefly in Switzerland and Italy; size of a field-fare; it is a solitary bird; wags its tail, feeds on seeds, fings with a very weak voice, and builds on the ground, or in the clefts of rocks. The upper mandible is brown, lower yellowish, terti with brown; breast brownish; the belly is rufous; quill-feathers blackish, the edge at the tip and inner side reddish; tail brown; legs of a horn-colour.

**Dauuricus**. Body above violet-black; beneath ash-white; the head and neck blueish; crown with a violet-black bluish; but in the female it is brown. This species is found chiefly among the oxier plantations of Dauria; it is above six inches long, and feeds on vegetables and insects. The bill is black, and more convex than in others of its tribe; the tongue is blackish; the irides brown; downy eyelids and lores white. The head of the male is cinereous; the back is of a grey-brown; the wing-coverts of the male are black; silky-green; the secondaries terti with white; the quill-feathers are black; the two inner ones terti with white; the primary ones are terti with green; the tail is sub-forked, greenish-black; the coverts violet; legs blueish-black.

**Stuthof**, in Geography, a town of Prussia, in the Frich Neurng; 14 miles N.N.W. of Elbing.

**Stuthy**. See Stuthy.

**Stutinum**, a town of Bohemia, in the circle of Chrudim; 3 miles S. of Chrudim.

**Stuttgarten** or **Stuttgard**, the capital of Wurtemberg, and residence of the king, situated in a delightful country on the Nutenbach, about two miles from the Neckar. The town is not large, but contains two well-built faubourgs. It is the see of a bishop, which was removed from Beutelsbach in the year 1321. The streets are large and straight, and the houses handsome. The royal palace is a magnificent building, and was begun in the year 1746. Stuttgarden contains an academy of painting, sculpture, and architecture, established in the year 1701; and manufactures of fluff, silk stockings, and ribbons.

The origin of this town is uncertain; in the year 1285, it was besieged, without success, by the emperor Rudolph I.; but in 1287, he reduced count Eberhard to such straits, that he was compelled to promise the demolition of the walls of the city. In the years 1520 and 1567, the whole city was surrounded with walls; in 1546 and 1547, it suffered greatly by the Spaniards; in 1634, and the following years, by the Imperialists; and in 1688, 1693, and 1707, by the French: 40 miles N.W. of Ulm. N. lat. 49° 45'. E. long. 9° 18'.

**Stut-**
STUTZENBERG, a town of Austria; 5 miles N.E. of St. Polten.

STUYVER, in Coinage. See Stiver.

STUZZITZA, in Geography, a town of European Turkey, in Macedonia; 80 miles N. of Saloniki.

STY, (Horodeum,) a small inflammatory tumour on the edge of the eye-lids. See Horodeum.

STY, Pig, in Rural Economy, a term used to signify the place where pigs are confined and kept, especially when of the small, rude, unfinished kind, such as are connected with cottages. See Hoo-Sty, Pigery, Pig-Cage, &c.

Improved fies of this fort are made by raising the feeding and sleeping places a little above each other, and both above the yards.

STYCA, in Cordage. See Stica.

STYGIA AQUA, a term used sometimes to express aqua regia; sometimes for the other strong acid spirits.

STYGIAN Liquors, a term which some chemists apply to the corrosive acid spirits, as aqua regia, from their efficacy in destroying or dissolving most bodies.

STYLE, in Botany. See Styline.

STYLE, in Chronology, denotes a particular manner of accounting time, with regard to the return to the reference of 10 days from the calendar, in the reformation made of it under pope Gregory XIII. See Calendar.

Style is either old or new.

STYLE, Old, is the Julian manner of computing, which obtains in some Protestant States, who refused to admit of the reformation.

STYLE, New, is the Gregorian manner, followed by the Catholics, and others, in consequence of that reformation.

The Julian, or old style, agrees with the Julian year, which contains 365.25 days.

The Gregorian, or new style, agrees with the true solar year, which contains only 365.2425 days.

In the year of Christ 2000, there was no difference of styles, but now there has arisen a difference of 11 days between the old style and the new, the latter being so much more accurate to the former; so that when the Catholics, e.g., reckon the 31st of May, those who use the old style reckon the 10th.

There are several places where the new style obtains even among Protestants; and it is not unlikely that the old style may, in time, dwindle quite away.

At the dict of Ratibon in 1700, it is decreed by the body of Protestants of the empire, that 11 days should be retrenched from the old style, to accommodate it, for the future, to the new. And the same regulation has since fallen into Sweden, Denmark, and into England, where it was established by 24 Geo. II. c. 25, which enacts, that in all dominions belonging to the crown of Great Britain, the suppuration, according to which the year of our Lord begins on the 25th day of March, shall not be used from and after the last day of December, 1751, and that henceforth, the 1st day of January every year shall be reckoned to be the first day of the year; and that the natural day next immediately following the 3d day of September 1751, shall be called and reckoned the 14th day of September, omitting the 11 immediate nominal days of the common calendar; and that the several natural days succeeding the 14th, shall be called and reckoned forwards in numerical order from the 14th day of September. Moreover, it is enacted, that all kinds of writings, &c. shall bear date according to the new method of suppuration, and that all courts and meetings, &c. feasts, fairs, &c. shall be held and observed accordingly. And for preferring the calendar in the same regular course for the future, it is enacted, that the several years of our Lord 1800, 1900, 2100, 2200, 2300, &c. except only every 400th year of our Lord, of which the year 2000 shall be the first, shall be common years of 365 days, and that the years 2400, 2800, &c. and every other 400th year from the year 2000 inclusive, shall be leap years, consisting of 366 days. See Bisextile and Calendar.

The following table shews by what number of days the new style differs from the old, from 5900 years before the year of Christ's birth, to 5900 years after it. The days under the sign - (viz. from 6000 years before to 200 years after Christ) are to be subtracted from the old style to reduce it to the new; and the days under the sign + (viz. from 200 to 5900 years after Christ) are to be added to the old style to reduce it to the new.

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STYLE.

STYLE, in Dialling, denotes the gnomon or cock of a dial, raised on the plane of it, to project a shadow.

STYLE, in Grammar, is a particular manner of delivering a man's thoughts in writing, agreeably to the rules of syntax; or, as F. Burner more accurately defines it, the manner in which the words, constructed according to the laws of syntax, are arranged among themselves, suitably to the genius of the language.

This definition fixes the notion of style to something determinate, which before was very vague and arbitrary; whence many authors, even of note, confounded it with syntax itself.

From the definition it appears, that the style supposes or includes the syntax; and that syntax does not extend so far as style; for the syntax may be very just, where the style is wretched.

Indeed, against what particular rule of grammar the fault is committed, it is scarce possible always to determine precisely; the taste and use of a language being so exceedingly delicate and precarious. It is true, a fault in style is not a fault against grammar than is a fault in syntax; only the former is less precise and palpable than the latter.

A very common error in grammarians, F. Burner adds, is to confound two kinds of styles in one; the grammatical style, or that directed by the rules of grammar; and the personal style, which depends less on the grammar than on the person that writes; whether with regard to his particular taste and genius, or with regard to his matter, or the kind or character of his work.

There are a great many differences between the two; the most essential is, that the one may be diversified an infinite number of ways, and the other cannot. In effect, the personal style is naturally variable, according to the different genuses, humour, and complexions.

It is the imagination that affects, that conceives, that proposes, and that expresses things according to its character, which is different in all men; and which is to be varied according to the particular kind of the work.

Hence arise the gay, the grave, the florid, the jejun, the copious, the concise, the poetical, the epistolary, and the burlesque styles.

These personal styles are all independent of the grammatical; and we have authors who excel in the one, yet are miserably defective in the other. The personal style is not under the direction of grammar, but of the imagination, or rather of rhetoric, that art having to do directly with our thoughts, as grammar with our words.

This, however, be it said, that grammar is far from being able to vary the same words of a phrase with equal perfection; and that generally there is but one way of delivering them in the tinct and genius of the language.

But in the personal style, where the imagination comes to be concerned, a sentence may be varied infinite ways, according to the kind of the writing, whether oratorical, poetical, &c.

In a philosophical style, the only end is accurately to explain our thoughts to others; whence the particular rules to be observed by a philosopher, in delivering his doctrines, naturally follow; such as:

1. Not to deviate from the received significations of terms.
2. That the same terms be always taken in the same sense.
3. To fix the meaning of such words as have only a vague sense.
4. To signify objects essentially different, by different names.

From these rules, the use and necessity of terms of art appear, and we see with how little reason they are vulgarly condemned.

5. The philosopher ought always to make use of proper expressions, and use no more words than what are precisely necessary to establish the truth of his doctrines. Wolf. Diff. Prælim. Logic. c. 5.

STYLE, in Jurisprudence, the particular form or manner of proceeding in each court or jurisdiction, agreeable to the rules and orders established in them. Thus we say, the style of the court of Rome, the court of chancery, of parliament, of the privy council.

STYLE, in Music. See STYLO.

STYLE in Oratory and Poetry, is restrained wholly to what F. Burner calls the personal style. Accordingly it may be defined to be the peculiar manner in which a man expresses his conceptions by means of language.

Style has always some reference to an author's manner of thinking. In other words, style is nothing else than that sort of expression which our thoughts most readily assume. Hence, different countries have been noted for peculiarities of style, suited to the different temper and genius of their inhabitants. Thus, the eastern nations animated their style with the florid and most hyperbolical figures. The Athenians, a polished and acute people, formed a style accurate, clear, and neat. The Africans, gay and loose in their manner, affected a florid and diffuse style. The like fort of characteristic differences are commonly remarked in the style of the French, the English, and the Spaniards.

Words being the copies of our ideas, there must always be a very intimate connection between the manner in which every writer employs words, and his manner of thinking; and from the peculiarity of thought and expression which belongs to him, there is a certain character imprinted on his style, which may be denominated his manner. This character results from the whole tenor of his language, and comprehends the choice which he makes of single words, his management of these in sentences, the degree of his precision, and his embellishment by means of musical cadence, figures, and other arts of speech. Although different subje克斯 require to be treated of in different sorts of style; so that the style of orations, for instance, should be different from that of treatises of philosophy; and different parts of the same composition require a variation in the style and manner; yet, amid this variety, we still expect to find, in the compositions of any one man, some degree of uniformity or consistency with himself in manner; or some predominant character impressed on all his writings, which shall be f锭oted to, and shew most, his particular genius and turn of mind. The orations of Livy and of Tacitus differ much in style from the rest of their history; and yet in Livy's orations, and in those of Tacitus, we are able to trace one distinguising manner of each historian; the magnificent fulness of the one, and the sententious conciseness of the other. In general, characters of style were particularly regarded by the ancient critics; accordingly, Dionysius of Halicarnassus distributed them into three kinds, which he calls the orator, the florid, and the middle. By the orator, he means a style distinguished for strength and firmness, with a neglect of smoothness and ornament; for examples of which he gives Pindar and Æschylus among the poets, and Thucydides among the prose writers. By the florid, he means a style ornamented, flowing, sweet, depending more upon numbers and grace than strength; and as instances,
he mentions Hesiod, Sappho, Anacreon, Euripides, and principally Iphocrates. The middle kind is the jul mean between these, comprehending the beauty of both; in which class he places Homer and Sophocles among the poets, and in prose, Herodotus, Demosthenes, Plato, and even Aristotle, thus unaccountably extending his terms to so to comprehend under one article, as to style, Plato and Aristotle. Cicero and Quintilian make a three-fold division of style, though with respect to different qualities of it, in which they are followed by most of the modern writers on rhetoric: the simple, tenue or subtile; the grave or sober; and the medium, or temperament genus discendi: in other words, the low or plain, the lofty or sublime, and the middle, temperate, or equable. See Style, in Grammar, supra.

The several characters are distinguished from one another, both by the thought and by the language.

The low, or simple style, pertains to subjects that are either common things, or to such as should be treated in a plain and familiar way; and, therefore, plain thoughts are most suitable to it, and distingiuished it from the other characters of style. By plain thoughts are meant such as are simple and obvious, and seem to rise naturally from the subject, when duly considered; so that any one, upon first hearing them, would be apt to imagine they must have occurred to himself.

Cicero's account of the flight between Milo and Clodius, in which Clodius was killed, is a remarkable instance of natural plainness and simplicity. Pro Mil. c. 10.

There are two properties of plain thoughts, one of which ought constantly to attend them in common with all beauty, and the other is often necessary to animate and enliven this character. The first of these is juvenile and propriety, which is what reason dictates in all cases; and the other property, which should often accompany plain and simple thoughts, is, that they be gay and sprightly; because the fewer ornaments this style admits of, the greater spirit and vivacity are requisite to prevent its being dry and jejune; care, however, should be taken, lest, while fancy be too much indulged, the juvetness of the thoughts should be overlooked.

As to the language proper for the low style, it may be observed, in general, that the dres ought to be agreeable to the thoughts, plain, simple, and unaffected: elegance, or a proper choice of words and expressions, including both purity and perspicuity, should be an object of primary attention. Epithets should be used sparingly, because they enlarge the images of things, and contribute very much to heighten the style. The composition in this kind of style does not require the greatest accuracy and exactness. A seeming negligence, as it appears more natural, is sometimes a beauty. Short sentences, or those of a moderate length, are best suited to this character. Such a harmony of numbers, proportion of the several parts, and studied cadence, as are evident effects of art, should be avoided: and yet it is necessary to observe some proportions in the members, so that neither the ears be too much defrauded, nor the sense obscured. As to order, the plainest and clearest disposition, both of the words and members of sentences, and what is most agreeable to the natural construction, best suits with this character, of which perspicuity is one of the principal beauties: and a proper connection likewise of sentences, with a regular order in the dependence of things one upon another, very much contributes to this end. As to dignity of language, we may observe that tropes should be used cautiously. Verbal figures, which serve chiefly to enliven an expression, and give an agreeable turn, are often not improper for this character; nor the figures of sentences wholly to be excluded, especially such as are chiefly used in reasoning or demonstration. But those which are more peculiarly adapted to touch the passions, or paint things in the strongest colours, are the more proper ornaments of the higher styles.

Upon the whole, pure nature, without any colouring or appearance of art, is the distinguishing mark of the low style; the design of which is to make things plain and intelligible, and set them in an easy light. And, therefore, the proper subjects of it are epistles, dialogues, philosophical dissertations, or any other discourses that ought to be treated in a plain and familiar manner, without much ornament, or address to the passions. A freedom and ease both of thought and expression, attended with an agreeable humour and pleasantry, are its peculiar beauties that engage us; and as the plain style admits of fewer ornaments than the florid, and has little more to recommend it than its own native beauty and simplicity, the greater is the art necessary to render it agreeable and entertaining.

Middle, or equable style, pertains to subjects that are of weight and importance, and which, therefore, require both a gravity and a degree of expression; and the distinguishing marks of this style are fine thoughts. A fine thought, as distinguished from plain thoughts on the one hand, and lofty thoughts on the other, may be taken to be the same as a fine thought, as distinguished from expression, or of the following properties, viz. 1. Gravity and dignity, an indication of which seems to occur in Cicero's speech to Caesar (Pro Marcell. c. 8.) when he says, "It has often been told me, that you have frequently said, you have lived long enough for yourself. I believe it, if you ever lived, or was born for yourself only." 2. Beauty and elegance: this property is exemplified in the fine compliment which Pliny pays to the emperor Trajan, when he says, "It has happened to you alone, that you were father of your country, before you were made fo." Paneg. c. 21.

3. Delicacy: A delicate thought is that which is not wholly discovered at once, but by degrees opening and unfolding itself to the mind, difcloses more than was at first perceived. To this property Quinellian (Infi. Orat. lib. vii. c. 2.) seems to refer, when he says, those things are grateful to the hearers, which, when they apprehend, they are delighted with their own sagacity; and pleases themselves as though they had not heard, but discovered them. Of this kind is that of Pliny (Paneg. c. 22.) speaking of Trajan's entry into Rome: "Some declared upon first seeing you, they had lived long enough; others, that now they were more deftious to live." 4. Novelty, which is applicable not only to things absolutely new, but to the same thought set in a different light, or applied to a different occasion. Thus Cicero (De Orat. lib. iii. c. 11.) says of Caius: "Caius always excelled every other person, but that day he excelled himself;" and also of Caesar (Pro Marcell. c. 4.), "You had before conquered all other conquerors by your equity and clemency, but to day you have conquered yourself; you seem to have vanquished even victory herself; therefore you alone are truly invincible."

As to the language proper to the middle style, it may be observed in general, that as the proper subjects of it are things of weight and importance, though not of that exalted nature as wholly to captivate the mind, and divert it from attending to the diction; so all the ornaments of speech and beauties of eloquence have place here. Elegance, confining in the choice of single words, of those that are
STYLE.

are most full and expressive, and of proper epithets, and the most accurate composition in all the parts of it, have place here. Periods the most beautifull and harmonious, and of a due length, and wrought up with the most exact order, just cadency, easy and smooth connection of the words, and flowing numbers, are the genuine ornaments, which greatly contribute to form this charachter. But the principal distincion of style arises from tropes and figures. By tropes it is chiefly animated, and raised to its different degrees or charachters, as it receives a less or greater number of them; and those either more mild, or more strong and powerful. As to tropes, those which afford the most lively and pleasing ideas, especially metaphors, suit the middle charachter. Virgil's Eclogues are written in the lowe style, agreeably to the language of the shepherds; and his Georgics in the middle style, suited to the nature of the subject, and the greatest men in Rome, amusing themselves in rural affairs, who were the persons for whom they were designed. Accordingly, in the former (Eclog. v. ver. 37.) the following verse occurs:

"In felix lolium et fleriles nascentur avenae:"

In English:

"Wild oats and darnel grow instead of corn."

In the latter (Georg. lib. i. ver. 154.) the same sentiment is thus expressed:

"In felix lolium et fleriles dominuntur avenae:"

In English:

"Where corn is sown, darnel and oats command."

Upon which some critics have remarked, that where the same fene is intended, instead of the proper word nascentur, grow, the author substitues a metaphor, dominuntur, command.

Figures, both of words and sentences, also belong to this style; which admits of the finest description, most lively images, and brightest figures, that serve either for delight, or to influence the passions, without transport or ecstasy, which is the property of the sublime. The most considerable embellishments, that form the middle or florid style, are descriptions, the profopoeia, similitudes and comparisons, and the antithesis. These, and such like florid figures, are sometimes found in historians, but more frequently in orators; and indeed this middle character, in the whole of it, is best accommodated to the subjects of history and oratory. Cicero has excellently described this style in the following passage: "Est flusus quidam interjectus, intermedius, et quasi temperatus; nec acumen inferiorior nec fulmine utens superiorior, vicinus amborum, in neutro excellens, utriusque particeps." The same author calls it the florid and polished style; as in this all the graces and beauties of language are principally to be used.

Sublime style is that which is the most noble, as well as the most difficult part of the province of an orator; and, indeed, the noblest genius and greatest art are both requisite to form this charachter; but the justest propriety, joined with the greatest strength and highest elevation of thought, is required to complete the true sublime. Lofty and grand sentiments are the basis of this charachter of style; and, therefore, Longinus advises those who aspire at this excellence, to accustom themselves to think upon the noblest subjests. Lofty thoughts are principally those which relate either to divine objects, or to power, wildom, courage, beneficence, and such other things as are of the highest effect among mankind. Of the former sort is Cicero's decleration to Cæsar, in his intercessioun for Ligarius, when he says, "Men in nothing approach nearer to Deity, than in giving life to men:" and an instance of the latter fort occurs on the fame occasion, when he says, "Your fortune has given you nothing greater than a power, nor your nature than a will to fave many." Of the fame kind is the reply of Porus the Indian king, when, after his defeat by Alexander, being brought before him, and asked how he expected to be treated, he answered, "Like a king:" or that of Cæsar chiding the pilot, who was afraid to set out with him in a form, "Quid times? Cæfarem vehis." It is proper to remark, that the true sublime is confident with the greatest plainness and simplicity of expression: and, generally speaking, the more plain and natural the images appear, the more they surprize us. Of this kind is the expression of Cæsar, upon his victory over Pharnaces, "I came, I saw, I conquered." But there cannot be a greater or more beautiful example of this, than what Longinus has taken notice of from Moses: "The legislator of the Jews," says he, (lect. 9.) "no ordinary person, having a just notion of the power and majesty of the Deity, has expressed it in the beginning of his laws in the following words: And God said: What? Let there be light, and there was light. Let the earth be made, and it was made." The image of a thing is sometimes much heightened, when it is expressed in so undetermined a manner, as to leave the mind in suspense what bound it to fix to the thought. An instance of this kind occurs in Milton's description of the fall of Satan. Parad. Loth, book ii.

"—— And to this hour
Down had been falling."

As to the language proper for the sublime style, elegance, composition, and dignity, which comprehend all the properties of style, are to be particularly regarded. With respect to elegance, those words and expressions chiefly contribute to form the sublime, which are most sonorous, and have the greatest splendour, force, and dignity; and they are principally long words, which are preferable to short ones, and especially monosyllables; compound words rather than simple ones; and also epithets, the use of which contributes in a particular manner to this charachter. The force of composition is so great, as Longinus observes (lect. 59.), that sometimes it creates a kind of sublime, where the thoughts themselves are but mean, and gives a certain appearance of grandeur to that which otherwise would seem common. Sublimity arises from the several parts of a period so connected, as to give force as well as beauty to the whole. The periods, therefore, in this charachter of style, should be of a proper length; neither too short, so as to lose their just weight and grandeur; nor too prolix, so as to lose their force, by becoming heavy and unwieldy. And more especially, nothing should be admitted that is superfluous, which very much enervates the force of a sentence. Besides, the order and disposition of the several words and members of a sentence should be regarded; as the different placing of one or two words will sometimes wholly destroy the grandeur of a sentence, and make it extremely flat. Another thing to be attended to in composition, is the connection of words, with regard to the sound; that the pronunciation, in passing from one to another, may be most agreeable to the ear, and best suited to the nature of the subject. Soft and languid sounds are very unuitable to this character; and, in this respect, therefore, our tongue, by its multitude of consonants, is more suited for sublime discourse than some other modern languages, which abound with vowels. The dignity of style depends on the proper
STYLE.

All the qualities of a good style, says Dr. Blair, may be ranged under the two heads of perspicuity and ornament. For all that can be required of language is, to convey our ideas clearly to the minds of others, and, at the same time, in such a dres, as by pleasing and interesing them, shall most effectually strengthen the impressions we endeavour to make.

Perspicuity, considered with respect to words or phrases, requires, according to this writer, these three qualities, purity, propriety, and precision. The former is the use of such words, and such constructions, as belong to the idiom of the language which we speak; in opposition to words or phrases that are imported from other languages, or that are obsolete, or new coined, or used without proper authority. Propriety is the selection of such words in the language, as the bell and most established usage has appropriated to those ideas which we intend to express by them. And as the words which a man uses to express his ideas, may be faulty in three respects; not expressing the idea which the author intends, but some other which resembles it; or expressing that idea incompletely; or, again, expressing it, together with something more than he intends; precision is opposed to all these three faults, but chiefly to the last. The proper opposite to precision is a loose style.

In the construction of sentences, according to this writer, the most essential properties are clearness and precision, unity, strength, and harmony. The first is opposed to ambiguity in the arrangement of words in a sentence; and is to be attained by observing exactly the rules of grammar, as far as these can guide us, and by placing the words or members most nearly related as near to each other as possible, so as to make their mutual relation clearly appear; particularly, that adverbs may always be made to adhere closely to the words which they were intended to qualify; that, where a circumstance is thrown in, it may be determined by its place to one or other member of it; and that every relative word which is used may infantly present its antecedent to the mind of the reader without the least obscurity. In order to preserve the unity of a sentence, the scene, during the course of the sentence, should be changed as little as possible; things, which have so little connection, that they could admit of being divided into two or three sentences, should never be crowded into one sentence; all parentheses in the middle of sentences should be avoided, and the sentence should be always brought to a full and perfect close. The strength of a sentence is such a disposition of the several words and members, as shall bring out the force to the best advantage; as shall render the impression, which the period is designed to make, most full and complete, and give every word and every member its due weight and force. For this purpose, care should be taken to prune the sentence of all redundant words and members; particular attention should be had to the use of copulative, relatives, and all the particles employed in transition and connection; the capital word or words should be disposed of in that place of the sentence, where they will make the fullest impression; the subject most unerring and growing in their importance above one another, so as to form a climax; the conclusion should seldom consist of an adverb, preposition, or any inconsiderable word; and in the members of a sentence, where two things are compared or contradicted to one another, where either a resemblance or an opposition is intended to be expressed, some resemblance in the language and construction should be preferred.

In the harmony of periods, we may consider agreeable found, or modulation in general, without any particular expression, and the found so ordered, as to become expressive of the
STYLE.

the fenile. The first depends on the choice of words, and the arrangement of them, with respect to which no writer equals Cicero, who was fond, perhaps to an excess, of the *plena ac numerosa oratio*.

There are two things on which the music of a sentence chiefly depends, viz. the proper distribution of the several members of it, and the close or cadence of the whole, which should be so contrived, that the sound should be made to grow to the last; the longest members of the period, and the fullest and most sonorous words, being referred for the conclusion. This rule, however, ought to be observed with restraint; for all unmeaning words, introduced merely to round the period, or fill up the melody, *complementa numerorum*, as Cicero calls them, are great blinemies in writing. Of found adapted to the fenile there are two degrees, one the current of sound, adapted to the tenor of a discourse, and a particular resemblance affected between some object and the sounds that are employed in describing it.

The second quality of style is *ornament*, which arises partly from a graceful, strong, or melodious construction of words, and partly also from figurative language, which is prompted either by the imagination or the passions. Figures contribute to the beauty and grace of style, by enriching the language, and rendering it more copious; by bestowing dignity upon style; by giving us the pleasure of enjoying two objects presented together, without confusion; the principal idea, which is the subject of the discourse, along with its accessory, which gives it the figurative drefs; and by giving us frequently a much clearer and more striking view of the principal object, than we could have if it were expressed in simple terms, and divested of its accessory idea. See Figure, Tropes, Metaphor, &c.

With respect to the use of figures, Dr. Blair observes, that neither all the beauties, nor even the chief beauties of composition, depend upon tropes and figures; that, in order to their being beautiful, they must always arise naturally from the subject; that they must not be employed too frequently; and that, without a genius for figurative language, none should attempt it.

This writer considers the various kinds of style; the first and most obvious distinction is that which arises from an author's spreading out his thoughts more or less; and which forms what are called the diffuse and the concise styles. Each of these has its advantages, and each becomes faulty when carried to the extreme. Discourses that are to be spoken, require a more copious style than books that are to be read. Of concisenee, the two most remarkable examples are Tacitus and Montesquieu in *l'Esprit de Loix*. Of a beautiful and magnificent diffusenee, Cicero is the most illustrious instance; Addison also and sir William Temple belong to this class.

The nervous and the feeble are generally held to be characters of style, of the same import with the concise and diffuse. They often coincide, inomuch as diffuse writers have generally some degree of feebleness, and nervous writers will generally be inclined to a concise expression. However, there are instances of writers that, whether of a full and ample style, have maintained a great degree of strength. Livy is an example; and in the English language Dr. Barrow. One of the most complete models of a nervous style is Demosthenes, in his Orations.

The restoration of king Charles II. seems to be the era of the formation of our present style in Great Britain. Lord Clarendon began, sir William Temple polished the language still more, and the author who formed it more than any one into its present state, is Dryden. Since his time, considerable attention has been paid to purity and elegance of style; but it is elegance rather than strength, that forms the distinguishing quality of most of the good English writers.

Style, with regard to the degree of ornament employed, may be divided into three classes; the first, that seems to rank in the following gradation, era, a dry, plain, neat, elegant, and flowery manner. The dry manner excludes ornament of every kind; and content with being understood, it has not the least aim to please either the fancy or the ear. Aristotle is a complete example of a dry style. A *plain* style rifies one degree above a dry one. A writer of this character gives us his meaning in good language, distinct and pure, but seeks no further ornament; either because he thinks it unnecessary to the subject; or because his genius does not lead him to delight in it, or because it leads him to defile it. Dean Swift is placed at the head of those that have employed the plain style; and among our philosophical writers, Mr. Locke comes under this class. The next style makes use of ornament, but not of the highest or most sparkling kind. The attention of a writer of this character is shewn in the choice of his words, and in a graceful collocation of them, rather than in any high efforts of imagination or eloquence. A familiar letter, or a law paper on the driest subject, may be written with neatness; and a sermon, or a philosophical treatise, in a next style, will be read with pleasure. An *elegy* style is the next degree of ornament, and is, indeed, the term usually applied to style, when poissessing all the virtues of ornament, without any of its excelle or defects. To this class we may refer Addison, Dryden, Pope, Temple, Bolingbroke, Atterbury, and a few more.

When the ornaments applied to style are too rich and gaudy in proportion to the subject; when they return upon us too fast, and strive us either with a dazzling lustre, or a false brilliancy; this forms what is called a *florid* style; a term commonly used to signify the excess of ornament. Dryden seems to be often the first writer to be called a florid, and it is not too strong a word. It is not the least pardonable, but even a promising symptom in young people, that their style shoule incline to the florid and luxuriant, but it is not estedile to the same indulgence from writers of mature years. Without a foundation of good fenile and solid thought, the moif florid style is but a childish imposition on the public.

Among the characters of style we may reckon that of simplicity, or a natural style, as distinguished from affection. Simplicity, with respect to style, stands opposed to too much ornament or pomp of language, and in this sense the simple style coincides with the plain or next style. Simplicity, as it regards style, may also denote the easy and natural manner in which our language expresses our thoughts, and stands opposed to affection or ornament, or appearance of labour about our style; and this is a distinguishing excellence in writing. Of this simplicity, Homer, Hesiod, Anacreon, Theocritus, Herodotus, and Xenophon, among the Greeks; Terence, Lucretius, Phedrus, and Cesar, among the Romans; and Tillotson, sir William Temple, and Addison, among English writers, are distinguished models.

Dr. Blair mentions another character of style, which he distinguishes by the name of strong, and which always implies strength, and is not by any means inconsistent with simplicity; but in its predominant character is distinguishable from either the strong or the simple manner. It has a peculiar ardent; it is a glowing style; the language of a man who has an imagination and passions are heated, and strongly affected by what he writes; who is therefore negligent of literary graces, but pours his heart forth with the rapidity and fulness of a torrent. This belongs to the higher kinds of oratory.
oratory; and, indeed, is rather expected from a man who is speaking, than from one who is writing in his closet. The orations of Demosthenes furnish a full and perfect example of this species of style. Among English writers, Lord Bolingbroke has most of this character, though mixed indeed with several defects. Blair’s Lectures on Rhetoric, &c. vol. i. paffim.

As to the choice of style, in the general, the nature of the subject is to determine it. Such style, says Cicero, is to be chosen, as expresses great things magnificently, middle things moderately, and low things subtly, or acutely; but more particularly, as those are three branches of the duty of an orator, to teach, to delight, and to move; the simple style is used to teach, the middle to delight, and the sublime to move.

Again, the simple or low style is fit for comedy; the sublime for tragedy; and the middle for history. Cæfar, it is true, rather used the simple than the intermediate style, but then he wrote commentaries, not a history, as is observed by Tully.

Again, the simple style is fit for exulcories and eleguces; the intermediate style for georgics; and the sublime for epics: which triple difference we easily discover in Virgil, though he sometimes mixes them all in the Aeneid itself, using the simple style in the fifth book, where he describes games, and the intermediate in the beginning of the poem. Care is still to be taken, that the style be not flat and dull, on pretence of being simple.

M. Boileau observes, that in all languages, a mean thought, expressed in noble terms, is better liked than the noblest thought expressed in mean terms: the reason he gives is, that every body cannot judge of the force and justness of a thought; but scarcely any but perceives the meanest of words. The latter we find by our senses, the former only by our reason.

It is neither easy nor necessary, says Dr. Blair, to determine what is precisely the best style. Some general qualities, indeed, there are of such importance, as should always, in every kind of composition, be kept in view; and some defects we should always study to avoid. An ostentatious, a facile, a harsh, and an obscure style, for instance, are always faults; and peripety, strength, neatness, and simplicity, are beauties always to be aimed at. But as to the mixture of all, or the degree of the qualities, or the exclusion of the defects, for forming one peculiar distinguishing manner, no precise rules can be given; nor is it easy to point out any one model as absolutely perfect. Dr. Blair proposes the following directions concerning the proper method of attaining a good style in general: leaving the particular character of that style to be either formed by the subject on which we write, or prompted by the bent of genius. For this purpose, we should study clear ideas on the subject concerning which we are to write or speak; the frequent practice of comparing with attention and care is indispensably necessary: we ought to render ourselves well acquainted with the style of the best authors, and yet, at the same time, be cautious in avoiding a servile imitation of any one author whatever: we should always study to adapt our style to the subject, and also to the capacity of our hearers, if we are to speak in public: and it should be remembered, that attention to style ought not to engross us so much, as to detract from a higher degree of attention to the thoughts. "Cu-ræ-s, " says the great Roman critic, "erunt voli effer efoliatus." Lect. on Rhet. I. II. x. xix.

The chief faults in style are, its being tumid and loud, or cold and puerile, or stiff, or loose, or dry and jejune.

**STYLE.**

**STYLE, a Tumid, is that which is immoderately flustered with big words and sentences; such are those verses of the emperor Nero, ridiculed by Petrus:**

"Torva mimallonea implerunt cornua bombis, Et raptum vitulo caput ablatura superbo.
Baffaris, et lyncem manas flexura corymbis, &c."

**STYLE, Frigid or Puerile, is that which affects certain trilling ornaments, insipid jells, remote and strained allusions, redundant dissertations, &c. Such, e. g. as a Cæsaur’s riding himself; more golden than gold, &c. Of this vice, that passage of Virgil seems guilty:**

"Num capiti potueru capi? Num incensa cremavi Troja viros?"

In the puerile style, the writer runs on in a species of verbosity, amusing his reader with synonymous terms and identical propositions, well-turned periods, and high-sounding words; but, at the same time, using those words in indifferently, that the latter can either affix no meaning to them at all, or may almost affix any meaning to them he pleases. See **Sublime Style, Superb.**

**STYLE, Locois, is that which, wanting articles, numbers, &c. fluctuates here and there, not connected or joined together: or, a loose style, in opposition to precision, generally arises from a superfluity of words; and the great source of it is the injudicious use of synonymous words. This is a fault so frequent, especially in young writers, that it is needed to give inferences of it.**

**STYLE, Dry or Jejune, is that which is destitute of ornament, spirit, &c.**

The ancients made a notable distinction of style, into **Laconic and Asatic.**

**STYLE, Asatic, is that which is very florid, dilatory, and prolix; or where abundance of words are used to express a little matter: thus called by the Greeks from the people of Asia, who affected such redundancies, in opposition to the **STYLE, Laconic,** which is distinguished by its exceeding conciseness, and by comprehending much matter under a few words.

Such, e. g. is that answer returned by the Lacedæmonians, to a long epistle of an enemy, threatening to destroy them with fire and sword: u. f. f. if; that is, do you think, or that returned by the fame people to King Philip, demanding some extravagant thing of them, u. n. n. or that of Cleomenes, the Spartan general, to the ambassador of Samos: "As to what you have said, the first part I do not remember; the middle I do not understand; the last I do not approve." Or that epistle of Archidamus to the Elei, who were preparing war against him. Archidamus to the Eleans: "It is good to be quiet." Or that of Cæsar to the Roman Senate, after his conquering Pharmaces, king of Pontus: "Veni, vidi, vici; I came, I saw, I conquered." See **Style of Dialogues.**

**Style, Epistolary.** See **Epistolary.**

**Style, Historical, is of a middle nature between that of a poet and an orator, differing from both not only in the ornamental parts, but likewise in the common idioms and forms of expressions. As history is a narrative of such facts as are fit to be transmitted to posterity, for the use of mankind, and the better conduct of human life, the first law in writing it is, as Cicero observes (De Orat. lib. ii. c. 15), not to dare to say any thing that is false; and the next, not to be afraid to speak the truth: that on the one hand there be no suspicion of affection, nor of prejudice on the other. The super-
superstructure of these foundations consists partly in things, and partly in the style or language. The former require an order of times, and description of places: and because in great and memorable events, we are disposed to know first their causes, then the actions themselves, and lastly their consequences; the historian should take notice of the springs or motives that occasioned them; and in mentioning the facts themselves, should not only relate what was done or said, but likewise in what manner; and in treating upon their consequences, shew if they were the effects of chance, wisdom, or imprudence. Nor should he only write the actions of great and eminent persons, but likewise describe their characters. As to the style, he says, (De Clar. Orat. c. 75.) that nothing is more agreeable in history than brevity of expression, joined with purity and peripetia. And he adds, in the place above cited, that it ought to be fluent, smooth, and even free from that harshness and poignancy, which are usual at the bar.

Dionysius (Epit. ad Cn. Pompe.) makes decency a principal virtue in an historian; which he explains by saying, that he ought to prefer the characters of the persons, and the dignity of the actions of which he treats; and, therefore, an historical style should be animated with a considerable degree of life and vigour.

Painting and imagery will form no small part of the historian's province, though his colours are not so fine and glittering as those of the poet or orator. He ought, therefore, to be well acquainted with the manners of men, and the nature of the passions, both of which he is often obliged to describe: in the former of which Herodotus excels, and Thucydides in the latter, as Dionysius has observed. From these several requisites, an historical style seems, upon the whole, to agree best with the middle character.

As to composition, which respects the structure of sentences and the several parts of them, Demetrius (De Interp. remark.) remarks, that an historical period ought neither to rise very high, nor sink very low, but to prefer a medium; i.e. these periods should neither be so full and honorious, as are frequent in oratory, nor yet so short and flat, as in dialogue. This simplicity, he says, becomes the gravity and credit of history, and distinguishes it from oratory on the one hand, and dialogue on the other.

The periods best suited for history are those which, being of a moderate length, will admit of just rise and cadency, and may be connected with ease. The harmony of periods arising from such a position of the words as renders the found pleasant and agreeable, ought also to be regarded in history. And as to dignity, which respects the use of tropes and figures, Dionysius says, that history should be embellished with such figures as are neither vehement, nor carry in them the appearance of art. This observation coincides with that of Cicero (De Orat. lib. ii. c. 14.) in comparing Xenophon and Callisthenes, two Greek historians.

Historical style, however, admits of considerable varieties from the different nature and dignity of the subject. The lives of particular persons do not require that strength and majesty of expression, nor all those ornaments of language, which suit an history of the Roman empire: and, accordingly we find the style of Nepos and Suetonius very different from that of Livy: the former being smooth and easy, fearlessly rising above the low character, and the latter often approaching near to the sublime. And other historians have observed a medium between these. Ward's Orat. vol. ii. t. 45.

Style, Lapidary and Marotic. See the adjectives.

Style of an Orator consists of the low, middle, and sublime characters, as they are applied by him in the different parts of his province. The orator has three things in view, viz. to prove what he affirms, to represent it in an agreeable light, and to move the passions; and each of these parts of his province requires a different style. The low style is most proper for proof and information; the middle style is most suited for pleasure and entertainment; because it consists of smooth and well-turned periods, harmonious numbers, with florid and bright figures. But the sublime is necessary, in order to sway and influence the passions. Here the orator calls in all the aids of nature and art; the most raised and lofty thoughts, clothed with the brightest and strongest colouring, enter into this character.

The Introduction scarcely rises above the middle style; and if it carry in it an air of pleasantry and good humour, it is generally the more apt to engage the attention.

The qualities of a good narration are clearness, brevity, and probability. The first arises from the choice of proper words, and such tropes as have been rendered most familiar by use; brevity requires moderate periods, whose parts are but little transposed: and a plain and simple drefs, without ornament or colouring, is best suited to represent things probable: all which are the properties of the low style. In the Proposition there can be no room for ornament. In the cool reasoning and debate of confirmation, the low style is certainly the most proper; but as the orator's method of reasoning often differs very much from that of the philosopher, and he endeavours not only to convince the judgment, but to affect the passions in a great variety of ways; his style is very different according to the nature and circumstances of the cause. The style of confusion is much the same with that of confirmation.

In that part of the conclusion, called disposition, the language ought to be forcible and strong, rather than florid, because brevity and conciseness are necessary qualities. But in the other branch of the conclusion, which is an address to the passions, all the springs of eloquence, says Quintilian, (Inf. Orat. lib. vi. cap. i.) are to be opened. Now we are palt the rocks and shallows, all the falls may be hoisted; and as the greatest part of the conclusion consists in illustration, the most pompous language and strongest figures have place here. Regard, however, must be had in every part of a discourse to the nature of the subject, the time, place, and persons, and other circumstances, by all which the style is to be regulated. Ward's Orat. vol. ii. t. 46. See Style, figure.

Style, ionic, a kind of bodkin of gold, silver, brass, iron, or bone, pointed at one end, for cutting the letters, and flat and broad at the other, for erasing any thing to be altered; with which the ancients wrote on plates of lead, or on wax, &c. and which is still used to write on ivory leaves, and paper prepared for that purpose, &c.

This is the origin of all the other significations of the same word in English. See a dissertation on the Style of the Ancients, in Phil. Trans. N. 150. p. 157. or Eames's and Martyn's Abr. vol. viii. p. 30.

Style, Stylus, in Surgery, denotes a long flexible instrument, which diminishes to a point at one end, so as to be of a conical form; serving either to expand and open, or to be thrust into any part.

The style is frequently to be thrust in red-hot in cancellure, and to be pulled out again immediately; it is put in and drawn out successively, as often as is necessary. In order to do this, it is useful to have two styles, to be put in alternatively.

STYLOPHORUS, in Ichthyology, a genus of fishes of the order Apodes. The generic character is as follows: The
The eyes are pedunculated, standing on a short, thick cylinder; the snout is lengthened, directed upwards, retracted towards the head by means of a membrane; the mouth is without teeth; it has three pairs of gills beneath the throat; the pectoral fins are small; dorsal as long as the back; the caudal short, with spinous rays; the body is very long, and compressed.

This of the singular genus, which consists of a single species, was first described in the year 1788, from a specimen at that time introduced into the Leverian museum, and figured in the first volume of the Linnean Transactions: the engraving is copied by Dr. Shaw in his fourth volume. The following is a description of the species.

Chorobatus, or Silvery Stylephorus, with extremely long caudal threads.

The head of this extraordinary animal bears a distant resemblance to that of the genus Syngnathus; which see. The rostrum, or narrow part, which is terminated by the mouth, is connected to the back of the head by a flexible leathery duplication, which permits it to be either extended in such a manner that the mouth points directly upwards, or to fall back, so as to be received into a sort of cleft formed by the upper part of the head. The eyes are placed at the top of the head; there are of a form very nearly approaching to those of the genus Cancer, except that the columns or panns on which each eye is placed are much broader or thicker than in that genus; they are also placed close together, and the outward surface of the eye, when magnified, does not show the least appearance of a reticulated structure. The colour of the eyes, as well as of the columns on which they stand, is a clear chestnut-brown, with a sort of coppery glint. Below the head, on each side, is a considerable compressed semicircular space, the fore-part of which is bounded by the covering of the gills, which covering seems to consist of a single membrane, of a moderately firm nature. Beneath, on each side, are three small pair of branchiae. The body is extremely long, and compressed very much, and gradually diminishes as it approaches to the tail, which terminates in a finning or procès of an enormous length, and finishes in a very fine point. This finning, or caudal process, is strengthened throughout its whole length, or at least as far as the eye can trace it, by a sort of double fibre or internal part. The pectoral fins are very small, and situated almost immediately behind the cavity, on each side the thorax. The dorsal fin, which is thin and soft, runs from the head to within about an inch and a half of the tail, when it seems suddenly to terminate, perhaps, in the living animal, it may proceed quite to the tail. From this point commences a smaller fin, which constitutes part of the caudal one. The caudal fin is furnished with five remarkable spines, the roots or originations of which may be traced to some depth in the thin part of the tail. The general colour of this fish is a rich silver, except on the flexible part belonging to the rostrum, which is of a deep brown: the fins and caudal process are also brown, but not so deep as the part just mentioned. There is no appearance of scales on this fish. It was from the singular figure and situation of the eyes, that it was given the name of the Stylephorus: the trivial name chorobatus was taken from the extraordinary thread-like process of the tail. It is a native of the West Indian seas, and was taken between Cuba and Martinico, near a small cluster of little islands about nine leagues from shore, where it was observed swimming near the surface. The whole length of this uncommon fish, from the head to the extremity of the caudal process, is about thirty-two inches, of which the process itself measures twenty-two. In Dr. Shaw's fourth volume is a very good representation of it, and in the Linnean Transactions the engraving is of the natural size of the fifth itself.

STYLES OF HUNTING. See HUNTING.

STYLE, Styletto, a small dangerous kind of poignard, which may be concealed in the hand; chiefly used in treacherous affinements.

The blade is usually triangular, and so slender, that the wound it makes is almost imperceptible. The filetto is strictly prohibited in all well-disciplined states.

STYLIDÆÆ, in Botany, a natural order, establisbhed by Mr. R. Brown, Prodor. Nov. Holl. v. 1. 565; and named from its principal genus. (See Stylidium.) Its characters are the following.

Calyx superior, in from two to six deep divisions, either two-lipped or regular, permanent. Corolla of one petal, its limb in five or six segments, irregular, rarely equal, imbricated in the bud; not quickly deciduous. Stamina two; their filaments combined longitudinally with the style, so as to form a column; anthers two-lobed, occasionally simple, lying over the stigma; pollen globose, simple, sometimes angular. Germen of two cells, sometimes but incompletely so, from the shortened partition, containing many seeds, mostly crowned either with a solitary gland in front, or with two opposite ones; style one; stigma either uniovulate or clavate. Capsule of two valves and two cells, with a parallel, occasionally incomplete, partition, which at length separates from the inferior margins of the valves. Seeds attached to the axis of the partition, erect, small, sometimes falcate; albumen of the shape of the seed, fleshy, rather oily; embryo included, minute.

The plants are herbaceous, or somewhat shrubby, not milky, with or without a leafy stem; their pubescence, when present, simple, either headed with a gland, or acute. Leaves scattered, in some infibuses whorled, undivided; their edges naked or fringed; crowded at the root in those species which have no stem. Flowers either spikèd, racemose, corymbose, or solitary, terminal, rarely axillary, their partial flowers-falks generally with three bractées. See Forsteria, Levenshookia, and Stylidium, the only known genera of this order.

STYLIDIUM, was first so called by the writer of the present article, who sent specimens under that name to LABillardiere and Swartz, and the latter published an account of the genus in the Transactions of the Natural History Society of Berlin, v. 5. Labillardiere has also adopted it, and our countryman Mr. Brown has greatly enlarged the number of known species in his Prodrorum. Meanwhile this same genus was published in our Exotic Botany by the name of Ventenatia, now otherwise applied; see that article. Stylidiun therefore is establisbhed, for the curious New Holland genus before us; and refers to the little calix, which supports and combines both anthers and stigma. Loureiro has indeed preoccupied this very name, Fl. Cochinch. 221, in favour of some rubaceous shrub that happened to have a feven-cleft flower; but there is great probability of his genus not being a good one, and we hope our Stylidiun will remain undisputed.—Sm. Introduct. to Bot. 4. A. 16. Swartz to Bot. 5. 343. Swartz Nat. Sertif. Berol. v. 5. Willd. Sp. Pl. v. 4. 146. Labill. Nov. Holl. v. 2. 63. Brown Prodor. Nov. Holl. v. 1. 566. Ait Hort. Kew. v. 5. 222. (Ventenatia; Sm. Exot. Bot. v. 2. 13.)—Cliffs and Order, Gymandria Diandra. Nat. Ord. Cœpitalae, Linn. Jull. Stylidiœ, Brown.

Gen. Ch. Cal. Perianth superior, of one leaf, in two deeply separated lips, one divided, the other three-cleft, permanent. Cor. of one petal; tube cylindrical, varius in length,
STYLIDIUM.

length, often crowded with glands; limb in five unequal, ovate-oblong, spreading segments, one of them a kind of lip, much smaller than the rest, and usually deflexed, mostly accompanied with a small appendage on each side, at the base. Stem. Column linear, longer than the limb, approximated to the lip, curved and recurved, irritable underneath, flying over to the other side of the flower when touched, its summit then becoming deflexed; anthers sessile at the top, of two vertical lobes, subquently greatly divericated, burrtling longitudinally. Pet. German inferior, roundish-ovate; style none, except the column; stigma between the anthers, and at first covered by them, afterwards rather prominent, obtuse, undivided. Sep. Capsule ovate-oblong, or linear, of two cells and two valves, with a parallel incomplete partition. Seeds numerous, small.


This is chiefly a New Holland genus, and highly remarkable for the irritability of the column in every species, as far as has been observed. That part, when touched underneath, at its outer curvature, flies over, by a sudden spring, to the opposite side of the flower, thus scattering the pollen, with force, upon the stigma. The species are forty-five in Mr. Brown's work; Swartz has two East Indian ones, all either herbaceous or somewhat shrubby, with or without a leafy stem. Leaves undivided. Inflorescence various. Corolla purple, white, or violet; rarely yellow; generally clothed externally with glandular hairs; its tube slightly twisted as the flower expands. Brown.

We have remarked in Exot. Bot. that no flower can be more truly gymnandrous, and that Stylidium shrivels the character of the class Gynandria really to exist in nature, which some botanists, contemplating only certain genera, erroneously so clasped, have doubted. We could never take the Gynandria for a natural clafs, or order, on that account, well knowing that not half a dozen of the really natural orders can be absolutely defined by a technical character.

Mr. Brown divides Stylidium into two principal sections, each of which is subdivided into many more. We shall select examples. Three species only have as yet found their way into our garden.

Section 1. Capsule falcate, nearly ovate, sometimes fibrous, sometimes oblong.


S. pilosum. Hairy-flaked Stylidium. Brown n. 1. Labill. Nov. Holl. v. 2. 65. t. 213.—Stalk somewhat branched, clothed with glandular hairs. Leaves flat, lanceolate-swordshaped. Native of the fourth part of New Holland, where it was gathered by both the authors cited. The leaves are numerous, erect, a span long, narrow, acute, smooth, tapering at each end. Stalks hollow, round, erect, a foot and half high, densely hairy. Cluster somewhat composed, of numerous flowers, whose calyx-lips are so deeply divided, that the whole calyx appears to consist of five sharp leaves.


Leaves much shorter, broader, and more spreading, than in the last, without any appearance of footstalks. Cluster of few flowers.

S. graminifolium. Grass-leaved Stylidium. Swartz as above, f. 1. Willd. n. i. Br. n. 7. Ait. n. 1. (Ventenatia major; Sm. Exot. Bot. v. 2. 13. t. 66. "Candollea ferrulata"; Labill. in Ann. du Mul. v. 6. 414. t. 64. f. 2."")—Leaves linear, finely toothed. Flowers nearly spiky. Whole flower-flake hairy. Lip with appendages at the base. Native of the neighbourhood of Port Jackson, as well as of the south coast of New Holland. Sent to Kew in 1803, by Mr. Peter Good. A green-house, perennial, herbaeous plant, flowered on mottled-flake of the summer. The edges of the narrow, rigid, erect leaves, are rough with minute teeth. Stalk from one to two feet high, or more, erect, straight, round, hairy and glandular from top to bottom. Flowers light purple, numerous, nearly sessile, in a long lax spike.

S. lineare. Linear Stylidium. Swartz as above, f. 2. Willd. n. 2. Br. n. 8. (Ventenatia minor; Sm. Exot. Bot. v. 2. 15. t. 67.)—Leaves thread-shaped, compressed, minutely toothed. Cluster simple. Partial flower-flakes nearly as long as the germs. Common flake smooth, fleshy. Lip with appendages at the base. Found near Port Jackson, and sent us with the former by Dr. White. Smaller in all its parts than graminifolium, with flowers nearly in the fame colour, or a little darker. Capsule leaf inflated.

Sec. 1. C. Leaves radical, crowded, without intermediate scales. A few scattered, never umbellate, bracteas sometimes on the flake. Calyx-lips deeply divided. Ten species of Brown, to which we add Swartz's two East Indian ones.

S. peltatum. Spatulate Stylidium. Br. n. 14.—"Leaves spatulate, entire, clothed on both sides with glandular hairs. Cluster many-flowered, smooth, as well as the radical flower-flake. Mouth of the tube clothed with glands. Lip with appendages."—Gathered by Mr. Brown on the south coast of New Holland.

S. glaucum. Glaucaous Stylidium. Br. n. 15. Labill. Nov. Holl. v. 2. 64. 214.—Leaves lanceolate-spatulate, entire, clothed on both sides with glandular hairs. Cluster of few flowers, rather corymbose, smooth; its common flake bearing a few bracteas. Native of the south coast of New Holland. Mr. Brown is not quite certain whether Labillardiere's synonym belongs to this or the last. His figure represents a small species, four or five inches high, with a tuberous root; small flowers, on long, bracteate partial flasks; and a large tuft of radical, nearly lanceolate, leaves, about an inch long, which he says are most glaucaous beneath.

S. tenerum. Little Malacca Stylidium. Swartz as above, f. 3. Willd. n. 3.—Leaves elliptical, obtuse; radical ones crowded. Stalk simple, slightly compressed. Cluster somewhat branched. Native of the East Indies, near Malacca. Stalk or stem an inch or two high, comes half an inch long; the lower ones crowded; upper alternate. Cluster of three or four flowers, simple, sometimes furnished with a short branch. Willdenowia.


Native of Ceylon. Stalk a span high, round, erect. Leaves as long as the stalk, crowded at the root. Bracteas on the common flake few, alternate, very minute. Willd.

Nothing being recorded concerning the calyx or capsule, we cannot be certain that the two last species properly belong to this division, or even to this section.

8 Sec.
S. corymbosum. Dwarf Corymbose Stylidium. Br. n. 32.—"Stalk round, corymbose. Leaves radical, linear, with a brilily point. Calyx-lobes deeply divided."—Gathered on the south coast of New Holland, by Mr. Brown. The stalk is two or three inches high.

Sect. 2. B. Stem leafy. Flowers either alternate or solitary. Calyx-linear, nearly cylindrical, of the same thickness at the top. Four species.

S. inundatum. Water Stylidium. Br. n. 33.—"Stem branched; leafy below its division. Leaves linear. Larger segments of the corolla obvate; smaller linear; mouth naked; lip without appendages, united to the base of the tube."—Discovered by Mr. Brown on the southern coast of New Holland. The stem is only about an inch and a half high.

S. diffusum. Spreading Stylidium. Br. n. 35.—"Stem thread-shaped, branched, loosely spreading. Leaves linear; those of the stem remote. Two larger segments of the corolla divided; mouth crowned; lip without appendages, united to the base of the tube."—Found by Mr. Brown in the tropical part of New Holland.

Sect. 2. C. Stalks single-flowered; from the boas of the crowded bracteas, or leaves, about the top of the stalk or branches. Calyx nearly cylindrical, of equal thicknesses at the top. Three species.


Sect. 2. D. Stem leafy. Clusters terminal. Calyx compressed, lanceolate or linear, contracted at the summit. Five species.

S. brevifolium. Short-flaked Stylidium. Br. n. 40.—"Stalk simple. Leaves thread-shaped, compressed; the upper ones closely crowded. Clutfer flaked, somewhat panicked, with a villain rachis. Calyx lanceolate, downy, with equal valves."—Gathered by Mr. Brown, after the flowers were faded, on the south coast of New Holland.

S. fulcatum. Falcate Stylidium. Br. n. 42.—"Stalk scarcely branched, slightly downy as well as the rachis. Leaves linear. Spike flaked, somewhat racemose. Calyx lanceolate, divaricated, both cells fertile, the uppermost closed, but half the width of the other."—From the same country. Brown.

Sect. 2. E. Limb of the corolla in two principal deep segments, each of them cloven. Calyx linear. One species.

S. albofides. Chickweed Stylidium. Br. n. 45.—"Stem erect. Leaves ovate; the floral ones opposite. Flowers axillary, sessile, solitary, without bracteas."—Gathered in the tropical part of New Holland by Sir Joseph Banks, and seen by Mr. Brown in a dried state only.

STYLIUM, in Anatomy, a procne of the temporal bone. See CRANIUM.

STYLIITUS, column, Sumi Columnaris, or Pillar Saints, in Ecclesiastical History, an appellation given to a kind of solitaryists, who fled into fences upon the tops of pillars, railed for this exercise of their patience, and remained there for several years amidst the admiration and applause of the stupid populace.

Of these we find several mentioned in ancient writers, and
even as low as the twelfth century, when they were totally suppressed.

The founder of the order was St. Simeon Stylites (see Simon), a famous ascetic in the fifth century, who first took up his abode on a column six cubits high; then on a second of twelve cubits; a third of twenty-two, a fourth of thirty-six, and on another of forty cubits, where he thus passed thirty-seven years of his life.

The extremities of these columns were only three feet in diameter, with a kind of rail or ledge about, that reached almost to the girdle, somewhat resembling a pulpit. There was no lying down in it. The faqirs, or devout people of the East, imitate this extraordinary kind of life to this day.

STYLOBATION, or STYLOBATA, in Architecture, the same with the pedestal of a column. It is sometimes taken for the trunk of the pedastal, between the cornice and the base, and then called trunci. It is also called by the name of abacus.

STYLOCORNYA, in Botany, so named by Cavanilles, from roto, a column, and coroa, a crown, because of the club-shaped figure of that organ.—Cavan. Ic. v. 4. 45.—Clais and order, Pandemia Monogynia. Nat. Ord. Rubiaceae, Juss.

Gen. Ch. Cal. Perianth inferior, of one leaf, tubular, with five teeth, permanent. Cor. of one petal, funnel-shaped; tube thrice as long as the calyx; limb in five deep, oblong, equal, widely spreading segments, twice the length of the tube. Stam. Filaments five, very short, inserted into the top of the tube, between the segments of the limb; anthers erect, linear, acute, the length of the limb, heart-shaped at the base. Fil. Germin inferior, globose; style club-shaped, as long as the stamens; stigma simple, acute.
Peric. Berry spherical, pulpy, crowned with the calyx, of two cells; seeds numerous, angular, hard, imbedded in pulp.

Eff. Ch. Corolla funnel-shaped; limb in five deep equal segments, longer than the tube. Berry of two cells, with many seeds, crowned by the calyx. Stigma simple. Anthers erect, pointed.

S. racemos/a. Cluttered Stylocoryna. Cavan. Ic. t. 368.—Found in the Philippine islands, and especially near Corisco, three leagues from Manila, by Louis Nee, in November 1793, when it was laden with flowers as well as berries. This is a small tree, whose trunk is twelve feet, or more, in height, with a grey bark, and an ample tuft of branches.

Leaflets opposite, stalked, elliptic-lanceolate, pointed, entire, smooth, with one rib and many veins, three or four inches long. Flowers about half an inch in length, combined and clasping the stem at the base. Clusters axillary, solitary, alternate, much branched, forked, many-flowered, smooth, with a pair of small awl-shaped bracteas under each subdivision. Calyx smooth. Corolla yellowish-white, hairy in the throat. Berry smooth, the size of a linseed pea.

This genus should be introduced into the Linnean system near Berberis, Wild. Sp. Pl. v. 1. 980.

STYLOY, in Anatomy, from the Latin styi, an instrument employed by the ancients in writing on their tablets, a name applied to some bony processes, and parts connected with them. The styloid processes of the temporal bone is the most remarkable of these: there is also such a process belonging to the radius and ulna. The styloid ligament is the slender thread passing from the styloid processes of the temporal bone to the os hyoideus.

STYLO-GLOSSUS, a muscle of the tongue. See DREGULATION.

VOl. XXXIV.
Linn. Sp. Pl. 1896. Loto pentaphyllo filicinóso villoso
amilis, Anonis non spinosa, foliis, cith infrar gluminosæ et
décoruis; Sloane Jam. v. 1. 186. t. 119. f. 1. Trifolium
n. 2; Browne Jam. 290.—Leaves ovate, fringed; downy
and gluminous on both sides. Spikes of few flowers.
Braétax fringed. Stem downy and gluminous, ereéct.—
Native of fandy rather hilly spots, in the southern part of
Jamaica, often intermixed with the foregoing. Swartz.
This agrees with the former in general habit, except in
growing upright, and in the gluminous, fragrant, more
hispid, blackish surface of the herbage. The Ripulæ are
frecked with red. Flowers yellow, turning red as they
deach, fewer in number than those of the preceding, or
the following. Their færand are purple at the base.
n. 3. (Arachis fruiticosa; Retz. Obs. fæc. 5. 26. Trifolium
procumbens zeylancicum hirfutum, loti facie; Burm.
Zeyl. 226. t. 106. f. 2.)—Leaflets elliptic-oblong, fringed;
rather hairy beneath. Spikes many-flowered. Braétax
fringed. Stem finely downy.—Native of dry situations in
Ceylon and Tranquebar. This is, no doubt, different
enough from the last, being devoid of all rigid gluminous
pubescence, not clothed with aspicyaryed hairy spots; but
there appears more difficulty, as Retzian suspected, in distin-
guishing it from the first species. The fæm is perhaps
as long, but seems procumbent, like that, as Burrman
describes it; not ereéct, as in the specific character given
by Retzian and Wildenow. The branches are numerous, finely
downy. Leaflets tipped with a small point. Flowers,
in the dry species from Konig, tinged with purple.
Swartz Stockh. Tr. as above, t. 11. f. 2. (S. hispida; Pursh
48c. Trifolium hirtum; Linn. by. Pl. rooch; Arachis
spicica; Walt. Carol. 182.)—Leaflets elliptic-lanceolate,
smooth. Spikes of two or three flowers. Braétax linear-
lanceolate, carelessly fringed. Stem smooth on one side;
downy on the other.—In dry gravelly fields and woods,
from Pennsylvania to Carolina, flowering in July and
August. Flowers yellow, small. Pursh. The fæm is
either ereéct or procumbent, leafy, but little branched,
a foot or more in height, very remarkable for having one side
only, opposite to the inflorescence of each leaf, densely downy.
Leaflets above an inch long. Common footstalk short.
Branches with upper fæmata clothed and fringed with strong
yellow bristles.
Swartz Stockh. Tr. as above. (Trifolium guianense;
Aubl. Guian. 2. 776. t. 509.)—Leaves lanceolate, pointed.
Spikes capitate, many-flowered, villous. Stem ereéct,
branched, hairy all round.—Found by Aublet, in the mead-
sows of Macouria in Guiana, flowering in June. The root
is annual. Stem a yard high, branched, very hairy in every
direction. Leaflets near an inch and a half long. Flowers
small, yellow, many together in each short roundish head.
Tube of the calyx very long and slender. Legume hairy, of
one joint only.
STYLUS, in Botany and Vegetable Phylogeny, the style
of flowers, is the part serving to elevate the Stigma above
the Germen. (See those articles.) This is not an effi-
tual organ, many flowers having the stigma, or stigmas, quite
sefsile upon the ember. In such cases the order of the
plant may be determined by the number of those stigmas; wittésis Vitisunm and Sambucus. But
where a single style is present, however numerous the
stigmas may be at its summit, the flower is considered as
monogynous. That impression must take place through
the style, or stigmas, is evident; but it is not as certain that

neither the pollen, nor even its elastic and subtle contents,
can be, in every instance, conveyed all through the style,
to the embryo of the seed. There is much more reason to
presume, that fecundation is accomplished by a sympathy
between the embryo and the stigma. Styles are sometimes
partially or entirely deciduous as the germin ripens, but
they often become enlarged and hardened for a subsequent
purpose. In Clematis, Dryas, &c. they grow out into
feathery wings, serving to waft the seed to a distance; in
Gewm, and many of the umbelliferous tribe, they form
hooks, by which their seeds flock to the coats of animals.
The latter purpose, on the contrary, in various syngene-
fous, or proper compound flowers, is accomplished by
peculiar appendages to the seed itself, the styles of this
family being, if we mistake not, always transient and de-
ciduous; as also in grageis, whose appendages, defined to
a similar purpose, are affixed, not to the seed itself, but to
its enveloping hulks. This last-mentioned natural order
affords a mos remarkable instance of disproportionately long
stigmas in the Maize, Zoa, where those parts resembale a penda
fliik tail, more out of the way, as it seems, of the
pollen, than usual. But the downy, though small, stigmas,
were calculated to meet the copious drops of the copious
duffy flower, which falls from the abundant anthers above.
The Zoa, however, has been well adduced as a wittens,
that the substance of the pollen itself cannot pass through
so long and impervious a part as the style of this plant.
STYMBARIA, in Ancient Geography, a town of Mac-
donia, belonging to the Deuriopas. Strabo.
STYMMATA, formed of γαμέω, I thicken, a word used
by some authors to express the stiff ointments. The an-
cients used the word both for the more solid and stiff oint-
ments, and for the ingredients which gave those ointments
that confinence: they also called by the same name the
several sweet ingredients which they put into their oint-
ments, to give them a fragrancy, and preferve them from
corruption; such were the powders of spikenard, mint,
amomum, and the several spices.
STYMPHALIA, γυμφάλαι, in Antiquity, a festival at
Stymphalus in Arcadia, in honour of Diana, called from
that place Stymphalia.

STYMPHALIA, in Ancient Geography, a country of Mac-
donia, in which was placed the town of Stymphalos.
STYMPHALIDES Aves, in Fabulous Animaity, birds of an
extraordinary fize, which, in their flight, are said to
obfusc the sun. They fed only on human flesh; but Her-
cules, by the help of Minerva, drove them out of Arcadia
by the noise of cymbals.

STYMPHALUS, or STYPHALE, in Ancient Geo-
graphy, a town in the N.E. part of Arcadia, nearly S.E.
of Pheneos, and N.E. of Orchomene. Here was a temple
of Diana Stympalide, and also a statue of this goddess
in gilt wood. The temple was ornamented with the figures
of birds, called Stymphalides, and behind it were statues
of young women with the tails of birds. Near Stymphalus
was a fountain, the water of which, according to Paufani-
as, was conducted by Adrian to Corinth, though a distance of
at least seven leagues, through mountains and across rivers.
—Allo, a river of Arcadia, which commenced a little S.E.
of mount Cyllene, and discharged itself towards the south
into a lake of the same name. This lake was rendered
famous by the destruction of certain large birds, which
Hercules had killed upon its banks. Others say that they
were driven away by the found of Stymphalos. Some have
explained this fable by telling us that robbers laid waste the
country, and robbed passengers on the confines of this lake.
These Hercules with his companions destroyed; and hence,
STY

it is said, sprung the fable of the birds Styphilates, whom
this hero was said to have banished, having invented a kind
of brazen tirisbels to fright them away, and which are said
to have been given to him by Minerva. The crooked
talons that are ascribed to them are perfectly applicable to
robbers, as well as the wings, the head, and iron beak, with
javelins of the same metal, which they darted at those who
attacked them, as we are told by Euripides and Claudian;
the import of which is, that they were armed with lances
and javelins. We are further told, that they were trained
up by the god Mars, to intimidate that they were very war-
like. Hercules contrived a method of dislodging them from
the woods where they sheltered themselves, by frightening
them with the sound of his tirisbels, and thus cut them off.

STYPANDRA, in Botany, a New Holland genus of
Mr. Brown's, named from thorn, thorn, or any similar sub-
stance, and a, a man, because the filaments are densely
bearded or tufted in their upper part. —Brown Prodr. Nov.
Holl. v. 1. 278. —Cliffs and order, Alexandria Monogynia.
Nat. Ord. Coronaria, Linn. Affreadelae, Jaff. Affreadelae,
Brown.

Ch. Cal. none. Cor. of one petal, in six deep,
wide, oblong, spreading segments, deciduous. Stem.
Filaments fix, tapering, curved, and smooth in the lower part,
densely bearded in the upper; anthers oblong, terminal,
attached by their emarginate base, becoming revolute after
the pollen is discharged. Pith. Germin superior, roundish;
tyle thread-like, the length of the filaments; stigma simple.
Peric. Capsule roundish, triangular, of three cells and
three valves. Seeds few in each cell, oval, smooth, with
a naked scar, and a straight embryo.

Eff. can. Corolla in fix deep equal segments, deciduous.
Filaments tapering and smooth at the base; densely bearded
above. Stigma simple. Capsule of three cells and three
valves, with several smooth seeds.

A genus of perennial herbaceous plants. The root
is tuberous, creeping, with clumped, thread-shaped fibres.
Leaves linear-two-angled, straight; those of the stem
in some instances numerous, two-ranked, with close, entire
sheaths; in others few, half sheathing at the base. Flowers
corymbose, or somewhat panicked, their partial filaufs rather
umbellate, jointed under the corolla, blue or white; the
beard of the filaments yellow.

Mr. Brown thinks this genus may possibly hereafter be
divided, its first section being more akin to Diandria, the
second to Anthorium; and that under the latter should be
arranged Anthorium constrictum and cardium of the Flora
Peruviana, p. 67. t. 299.

Seet. 1. Flowers drooping; their partial filaufs without
beards. Stem-leaves two-ranked, with undivided sheaths.
Seeds opaque.

1. S. glabra. Brown n. 1. —All the leaves distinct,
reverted; one of their edges reflexed at the base. —Found
by Mr. Brown near Port Jackson, New South Wales.

2. S. imbricata. Br. n. 2. —Leaves imbricated; their
margins simple at the base. —Gathered by the same botanist,
on the southern coast of New Holland.

Seet. 2. Flowers erect; their partial filaufs bracteated
at the base. Stem-leaves alternate, half sheathing at the base;
radical ones two-ranked, equal. Seeds fibrous.

3. S. capitata. Br. n. 3. —Radical leaves lwoed-shaped,
rough-edged; those of the stem shorter, smooth, below
its first or second division. Branches of the corymb un-
equal. Flower-filaufs umbellate, smooth as well as the cor-
olla. —Found by Mr. Brown near Port Jackson. The
radical leaves are from nine to twelve inches long, either
folded or flat. Flower-filaufs from three to five in each
umbel.

4. S. umbellata. Br. n. 4. —Radical leaves linear,
smooth-edged. Branches of the corymb alternate. Flower-
filaufs umbellate, smooth as well as the corolla. —Native
of the same country. Radical leaves narrow, from four
to eight inches long. Flower-filaufs two or three to-
gether.

5. S. flexa. Br. n. 5. —Radical leaves linear; those
of the stem nearly like them. Stalks of the corymb alter-
nate, rather hispid as well as the corolla. —Gathered by
Mr. Brown, on the southern coast of New Holland. The
radical leaves are either folded or flat; those of the stem
from three to five in number.

STYPHELIA, so named by Dr. Solander, from στύφος,
harsh and rigid, alluding to the habit of all the species.
v. 1. 537. —Ait. Hort. Kew. v. 1. 322. —Cliffs and order,

Gen. Ch. Cal. Perianth inferior, of five, equal, erect,
lanccolate leaves, with four, or more, smaller, imbricated
scales at the base, permanent. Cor. of one petal, tubular,
shortly cylin. Tube nearly ciliated; tube nearly cylindric;
base of the tube within the sepal. —In five deep, revolute
equal segments, bearded on the upper side. Neatly of five
glomerules at the base of the stem. Stem. Filaments five,
thread-shaped, equal, inserted into the tube, and projecting
beyond its orifice; anders incumbent, oblong, of one cell,
burting lengthwise. Pith. Germin superior, roundish,
serrowed, style thread-shaped, longer than the filaments;
 stigma obtuse, notched. Peric. Drupae but slightly succu-
lient, oval or globular. Seed. Nut hard and fould, of five
cells, with a pendulous kernel in each.

Eff. Cal. Outer calyx of four, or more, imbricated
scales. Corolla tubular, elongated, with five internal tufts
of hairs near the bottom; limb revolute, bearded. Fil-
aments prominent. Drupae rather dry, of five cells.

Mr. Brown, in consideration of the vast extent of
the original genus Stypelia in New Holland, almost rivalling
perhaps that of Erica in Southern Africa, has separated
therewith several genera, of some of which we have given
an account in their proper places. (See Leucopogon, Lib-
anthus, Micranthus, Monotoca, Neethamia, Oligar-
threna, Pentachondra, and Stypaxera.) An observa-
tion of the differences in the numbers of the scales of
the outer calyx, termed by him, not exactly in conformity to
Linnaean principles, bracteas; of the smoothness or hairiness
of the limb, or some other part, of the corolla; of the propor-
tion of the filaments, and of the number of cells in the drupe,
which latter character he alone has had sufficient opportu-
nities of examining, has afforded this correct and accurate
observer sufficient means for the establishment of very
commodious, if not always perhaps naturally distinct genera.
Of these, Leucopogon seems to us one of the best, and it is
fortunately very extensive; Monotoca, Neethamia, and Ol-
igarthrena, however, though small genera, are well defined.
The learned author is, nevertheless, so well aware of cer-
tain connecting or intermediate marks of affinity, which con-
cern other genera, that he candidly proposes the arrange-
ment in question for future consideration only. It seems to
us at least as good, and likely to be as permanent, as the
Linnaean genera of the natural order of Aftersella, which
have not yet been differentiated.

The Phylidae are, as Mr. Brown observes, erect or ascen-
ding thyrse, branched, and in general nearly smooth. Their
leaves are scattered, sharply-pointed, on very short foot-filaufs.

Flowers salivary, either drooping or spreading, handfo-

3 G 2

usually
STY

Usually one, rarely two or three, on a stalk. Their necha-
riferous glands are rarely combined. Seven species only, as
far as has yet been discovered, remain in this genus, all
native of New Holland, and all, except one, of New
South Wales, near Port Jackson.

1. S. longifolia. Long-leaved Styphelia. Br. n. 1.—
Leaves lanceolate, elongated, taper-pointed, smooth-edged;
rather concave on the upper side. Branches downy.
A native of the country near Port Jackson, for a fine spe-
cies of this herb. This species has not yet appeared in our gardens. It appears
to be a tall shrub, with many round, straight, downy, leafy
branches. Leaves nearly sessile, broad at the base, thence
becoming slightly ovate, and tapering gradually to a sharp,
straight, pungent point; their length from an inch and a
half to two inches and a half; both surfaces smooth; the
upper even; lower closely fringed with parallel subdivided
ribs. Flowers solitary, nearly sessile, very hand-some. Calyx
smooth, an inch long. Corolla twice as much; as far as we
can judge by the dried specimen, it seems yellowish; or
of an orange hue. The limb is covered on the upper side with
long and slender hairs of its own colour; tube externally
very smooth.

2. S. lea. Gay Styphelia. Br. n. 2.—Leaves elliptic-
oblong, imbricated, glaucous, rough-edged, nearly flat;
shorter than the flowers. Branches downy. Stem eros.
—Gathered near Port Jackson, by Dr. White and Mr.
Brown. The leaves are sessile, about an inch long, various
in breadth; somewhat downy above, at least when young;
faintly fringed at the back. Calyx of the same length,
reddish, finely bearded at the rim. Corolla twice as long,
orange-coloured or reddish, elegantly contrasted with the
glaucous foliage. Stigma somewhat capitate, the stamens,
as well as the filaments, projecting above half an inch beyond
the revolute corolla.

3. S. aspera. Diffuse Styphelia. Br. n. 3.—
"Leaves lanceolate, flat; glaucous and manifestly fringed
beneath; rough, with a tooth-like fringe at the margin.
Stem diffuse, with ascending branches."—Gathered by
Colonel Paterson in Van Diemen's island.

4. S. spicata. Broad-leaved Styphelia. Br. n. 4.—
"Leaves broad-obovate, acute, imbricated, rough-edged;
rather concave above. Flowers almost sessile."—Found by
Mr. Brown, near Port Jackson. We are not certain of
having seen specimens of this, any more than of the last.

Ait. n. 1. (S. viridis; A. and R. Rep. t. 318.)—Leaves
obovate-oblong, flat, obtuse, with a siphon point; smooth
and even above; minutely rough at the margin; spreading
widespread as well as the solitary flowers. —Found near
Port Jackson, by some of the earliest settlers in that country,
who sent seeds in 1791 to Meffre, Lee and Kennedy; and
from these a solitary plant was raised. The perfectly green
flowers, with brown anthers and style, render this species
remarkable. It blossoms in a green-house in the spring,
but requires delicate management with respect to water in
winter, being certain to perish if kept wet at that season
for any length of time. The flum is two feet, or more, in
height, erect, branching, leafy, finely downy. Leaves
rather longer, and more obvate, or obtuse, than in our
second species, and leaf glaucous. Flowers rather longer
than the leaves, but the proportion of their calyx and
corolla forms, in some degree, variable.

Ait. n. 2. And. Rep. t. 72.—Leaves elliptic-lanceolate,
flat, smooth in every part, rather glaucous. Branches
smooth. Flowers approximated, from one to three on each
stalk.—Native of the country near Port Jackson. First
raised, it is said, by George Hibbert, esq. in 1796. A
green-house shrub, flowering from June to August, and
very beautiful. In size it yields to none of the genus.
The crowded leaves are more or less ovate, or elliptic-
lanceolate, paler and finely fringed beneath. Flowers al-
ssembled towards the ends of the branches, but soon fur-
mounted by them; each axillary flum often bearing three
large spreading flowers, sometimes but one or two. The
flowers have six stamens on the rededit. Three of the calyx,
as well as the filaments, rose-coloured; the rest of the flower yellow.

n. 3.—Leaves linear-obvate, slightly revolute; convex and
roughish above. Flowers drooping.—Communicated in a
dry flate, with coloured drawings, from the neighbourhood
of Port Jackson, in 1791, by Dr. White. Sir Joseph
Banks is mentioned as having introduced this plant at Kew
in 1802, but it has not yet bloomed. The flum is bstitial,
with hairy branches and white young. Leaves much smaller
and narrower than any of those above described, with
pungent points like all the rest. Flowers copious, solidary,
regularly splendid and elegant, twice or thrice as long as
the leaves, a little drooping, the hairy segments of their
corolla of a deep rich crimson, the tube paler and yellowish.

Style capillary, very long.

STYPTIC, (20)
formed of 20th, asfringero, in Medi-
ces, asfringo, in Medicinis, asfringere, in Medi-
cine, asfringere; a remedy that has the virtue of stopping
blood, or of binding up the aperture of a wounded velief.

The ferveo, visite, Solomon's seal, &c. are syptics.

There are various styptic waters, and powders of great
efficacy, in most of which vitriol is the principal ingre-
dient.

The usuall styptic water is made of colochoar calcined,
and vitriol dissolved with burnt alum, fugar-candy, the urine
of a young man, &c.

Dr. Colbath's styptic powder has been famed; though
Mr. Cowper, in the Philosophical Transactions, gives us
a number of infusions, in which it was applied with very
little or ill success in human subjects; but he gives us other
remedies for dogs, where it answered well.

M. Turnerfort observes, from the analysis he has made of
styptic and astringent plants, that acids and earths always
prevail in them; though some of them yield an urinous
spirit. On this principle he affers, that their salt is
analogous to alum, and that there is somewhat of salt
ammoniac in their texture. But Chomel notes, that this does
not hold universally.

STYPTIC Powder of Helvetius, in Pharmacy, a composi-
tion of alum and dragon's blood. In the Edinburgh Dis-
pensatory, two parts of alum are directed to be made into
powder with one of the dragon's blood; others use equal

This medicine is said to be extremely servicable in uteri
haemorrhages, either to correct the too frequent re-
turn of the menses, or their too great abundance; also
to stop the bleeding, to which women with child are subje.
ct, and to moderate the flow of the lochia. It has also been
found to have surprizing good effects in the flor albus.

In violent bleedings it may be given in the quantity of
half a drachm every half hour, and it seldom fails of stopping
the bleeding before the quantity of three drachms, or half an
ounce, has been taken.

Heister also, in his "Compendium Medicinae Practicae," p. 143, recommends this powder, or alum alone, with
a decoction of linseed, from Helvetius's "Traité des Peres
de Sang." 

STYPTIC.
SYTY, Easton's, a medicine famous for curing fresh wounds in a very small time, and immediately stopping their bleeding.

The method of curing fresh wounds in a few days without suppuration, where neither nerves, large vessels, bones, nor any of the viscers are concerned, has been a practice long ago used.

The French were a long time very fond of a flyptic ball, made of the filings of iron and tartar, mixed to a consistence with French brandy, which was afterwards published by Helvetius, and from him has been generally known by the name of Helvetius's Flyptic. This was extolled with us as one of the greatest medicines in the world for the cure of wounds, bruises, and external injuries of all sorts; but the author never said so much about it; he only modestly introduced it into the world as a useful thing for a first dressing of fresh wounds with people who lived too far off for the immediate assistance of a surgeon; and he mentions several cafes in which it ought not to be used. In fine, he published it as a good medicine under proper restrictions; but we made it an universal one. The only universal remedy of this kind, that we have had since, is the famous flyptic of Dr. Eaton, which the inventor says is good to stop all manner of bleeding both without and within, without any manner of exception.

Sir Richard Blackmore, soon after the publication of this great secret, wrote a treatise on consumption, in which he highly extols this flyptic of Dr. Eaton, declaring positively, that it will be of more service to the world than all the discoveries that had been made before it. On this Dr. Sprengel, who had before examined Eaton's Flyptic, and judged it to be the same as Helvetius's Flyptic, but not having had the assistance of Helvetius himself, for having been tried and discarded in France, Germany, and Holland, had been set on foot as an universal medicine here, thought it worthy a more strict and public examination, and ordering an apothecary of credit to prepare some of Helvetius's flyptic in the common way, he produced, before a judicious audience, a bottle of that, and another of Eaton's flyptic; and giving them both the same trial, they both answered in the same manner, and proved, beyond all possibility of doubt, that they were in effect the same medicine.

Upon the whole, the virtues of these flyptics externally are too triving to be trusted to, and internally too precocious to meddle with, without the greatest caution. Philos. Trans. N° 383, p. 110.


Ob. Jussieu is doubtless more correct in his idea of the natural order of this genus than Linnaeus, who classed it in an appendix to his Bisornes, and yet thought it allied to Citrus. Although only one or two of the seeds come to their full size in a cultivated, or even a naturalized state, in England or Italy, more may be presumed to be perfected in the warm and arid climates of the Levant. Verrugineum. Storax officinale. Official Storax. Linn. Sp. Pl. 635. Wildl. n. 1. Ait. n. 1. Andr. Repof. t. 631. Woody. Med. Bot. t. 71. Sm. Fl. Grec. Sibth. t. 375, unpublished. Cavan. Diff. t. 168. f. 2. (Styrax; Mill. l. c. t. 260. Camer. Epit. 38. Matth. Valgr. v. 1. 80. Ger. Em. 1526.)—Leaves ovate, bluntish, wavy, entire, downy beneath. Clusters simple, of few flowers. Native of Syria, and mottled parts of the Levant. Mr. Hawkins informs us it is rather common all over Greece and the Peloponnesus, being known under the same name of magnum, in modern Greek. Dr. Sibthorpe found it called coccus, a slight alteration of its ancient appellation. The shrub is naturalized in hedges about Tivoli, and was cultivated in England by Gerarde, before the year 1597. It is occasionally met with in curious collections, being best preferred in a conservatory. A very large tree of this kind, trained against a wall in Chelsea's garden, and covered every year in May or June with a profusion of most elegant flowers, is by far the finest we ever beheld. The stem is bulby, forming a tall shrub, or small tree, with irregular, stowace, round, leafy branches, downy when young. Leaves deciduous, alternate, long, thick, entire, well compared by old botanists to those of a Quince; their upper surface is smooth, of a fine green; lower clothed with hoary flary down, much diminished as to quantity in a garden, the veins spreading from the rib at rather acute angles. Clusters terminating the young, short, lateral, leafy shoots of the present year, simple, downy, bearing from two to five or six white flowers, of the size and aspect of an orange-blossom. Calyx, as well as corolla, white and downy. Fruit leathery, the size of a gooseberry, sometimes ripened in Italy, but never in England, nor are the seeds perfected, even in gardens at Turin, so as to vegetate.

This shrub is chiefly remarkable for producing the valuable and highly fragrant gum called Storax; see that article. We presume the plant to have been cultivated by Adrian, at his celebrated villa near Tivoli, and thus to have become established in the neighbourhood. He is recorded to have introduced some curious exotics into his garden there; and the Abbé Richard, in his Description d'Italie, v. 6. 403, mentions the true Balm-tree, Amyris Balsamofforum, as one of the number; it was this was probably the Styrax only. See Sm. Tour on the Continent, ed. 2. v. 2. 344. De la Lande says, the wood is burnt at Rome in winter to perfume the apartments, a handful at a time being thrown on a brazier.

2. S. grandifolium. Large-leaved Storax. Ait. n. 2. Wildl. n. 2. Pursh n. 1. (S. officinalis; Walt. Carol. 1450.)—Leaves oblong, acute, somewhat toothed; downy beneath. Clusters simple, elongated, many-flowered; their lower flowers axillary. In woods on the banks of rivers, from Virginia to Georgia, blooming from June to August. A fine ornamental shrub. Pursh. Introduced into the English gardens in 1765, by Mr. John Cree. Asim. Michaux and Pursh have well defined this species and the following, though...
Michaux has accidentally written grandiflorum of Aiton, instead of grandifolium. The present species has much smaller flowers, though larger leaves, than the officinale. Its very downy chaffers terminate the young lateral shoot in the same manner, but besides eight or ten flowers, of which each is composed, each of the three or four leaves of the shoot is accompanied by an axillary flower, the middlemost leaf usually by two flowers, all of them drooping. The margins of the leaves are, more or less regularly, furnished with small, dimidiate glandular teeth.

3. S. pulverulentum. Powdery-leaved Storax. Michaux Boreal-Am. v. 2. 341. Pursh n. 2. (S. leucopetalum Curt. Mag. t. 92.)—Leaves obovate, obtuse, entire; powdery or downy beneath. Flowers axillary, with two or three in a terminal cluster. In the woods of Virginia and Carolina, flowering from June to August. Refeembles the lat. Pursh. Cultivated by Mr. Lodgises at Hackney, before 1806. Dr. Simms. We have seen no authentic specimen, but by the figure and description this seems sufficiently distinct from the grandiflorum, having smaller, more oblong leaves, distinct of marginal teeth; much smoother chaffers, consisting of, at most, two or three flowers, the rufous or purplish. The flowers are said to be eight only, but this is not correct.

4. S. Leucogumum Smooth Storax. Ait. n. 3. Willd. n. 4. (S. leucopetalum; Walt. Carol. 140. S. glabrum; Cavan. Dict. t. 188. f. 1.) Michaux Boreal-Am. v. 2. 341. Pursh n. 3. S. americana; Lamarck Dict. t. v. 82. Herb. Linn. f. 28.)—Leaves elliptic-lanceolate, acute at each end, unequally serrated; nearly smooth on both sides. Flowers almost all axillary; solitary or in pairs. In the swamps of Virginia and Carolina, flowering in July and August. Not above three or four feet high. The number of flowers is from six to ten. Pursh. This author thought the present species had not been introduced into Europe; but we have seen specimens in the herbarium of the younger Linnæus, from the English as well as from French gardens, which induce us to believe it the real levigatum of the Hortus Kewenens, introduced by Mr. Cree in 1765, and we therefore preserve that name. The leaves are smaller than in any of the foregoing, and often very deeply, though never uniformly, serrated. We do not find them always smooth, though very pale beneath; some specimens being being sprinkled in that part with minute prominent points, or hairs. Yet such specimens cannot be referred to the latter species. The flowers are almost entirely axillary, solitary or in pairs, small, white, drooping. Calyx somewhat downy at the base; coloured towards the margin. Dr. Garden sent specimens of this plant to Linnaeus, who neglected to describe them.

5. S. Benzoïn. Benjamin Storax, or Gum Benjamin Tree. Dryand, in Phil. Trans. v. 77. 308. t. 12. Willd. n. 3. Woodr. Med. Bot. t. 72. (" Arbor Benzoïnii; Grimm. in Eph. Acad. Nat. Cur. dec. 2. ann. 1. 370. fig. 31." Benjui; Garcia de Horme in Clus. Exot. 155.)—Leaves ovate, pointed, entire; downy beneath. Clusters axillary, compound.—Native of Sumatra. Marsden. Our specimen, said to come from Guiana, was communicated by Mr. T. F. Forster. The plant is a stranger in the gardens of Europe, and is very rare in dried collections. The branches are round, leafy, finely downy and hoary. Leaves about four inches long, and two wide, alternate, flaccid, rather pale; clothed beneath with dense downy, and elegantly reticulated with triply compound prominent veins, the principal of which have at their base a sort of glandular tumour. Footstalks downy, about half an inch in length. Stigmas none. Clusters axillary, solitary, or in pairs, seldom so long as the leaves, alternately branched, with angular, downy stalks, and a few small, oblong, concave, more downy, deciduous bracts. Flowers from six to twelve in each cluster, all turned upwards, white, scarcely so large as the S. officinale. Calyx bell-shaped, downy, with very minute teeth. Corolla four times as long, angular in the bud, somewhat silky, rather than downy. Stamens ten, united at the base into a tube almost as long as the calyx. Germs bristle. Stigma obtuse.

This, the true Benjamin, or Benzoïn, Tree, was first referred to its proper genus by the late Mr. Dryand; who being furnished with a sufficient specimen, could not fail to perceive that it was a Styrax. The valuable perfumed gum, yielded by this tree, is not less evidently akin to the gum Storax, in sensible qualities. (See Benzoïn.) Ray had erroneously supposed it the production of a North American shrub, thence named Laurus Benzoii by Linnæus. (See Laurus.) The latter, in correcting this error, fell into no less a mistake, making the Benjamin-tree a Cronus, in Mant. 2. 297, and a Terminilla, in Suppl. 434. To this he is supposed to have been led by the French name of this plant, Styrax Benzoïnii, or Terminilla. But he gives a better reason for the name, in justification of himself in the Supplementum, where he informs us that a piece of the trunk of the true Benzoin, brought by Thunberg, very closely agreed, in its singular bark, with the tree before him, which grew in the fove at Uspial.

STYRAX, in Gardening, furnishes an aromatic deciduous tree of the exotic kind, of which the species cultivated is the official forrax (S. officinale).

Method of Culture.—It may be increased by seeds obtained from abroad, by sowing them in pots of light earth an inch deep; and as they are of hardy, sonly nature, and rarely come up the first year, the pots should be plunged under a frame during cold weather, and be in the shade in summer, and in the second spring be plunged in a hot-bed to forward them, being careful to give water, and to harden the young plants gradually to the full air in summer, in a shady place during the hot weather, being often watered; and in winter the pots be replaced under a garden-frame, &c. to have shelter from frost; then in spring following let them be potted off separately, and managed as hardy green-house plants for three or four years, when some of them may be turned out into the full ground in a sheltered situation, trained against a south wall, and some may be retained in pots for the greenhouse collection; they afford ornament and variety in their different situations.

STYRIA, in Geography. See Stiria.

STYRNAS, a town of Sweden, in Angeramandland; 30 miles N. of Hernofland.

STYRSA, an island near the W. coast of Sweden, in the North Sea. N. lat. 57° 33'. E. long. 11° 52'.

STYRUM, a town of the duchy of Berg; 4 miles E.N.E. of Duisburg.

STYX, in Mythology, a river of Hell, or Aes, over which was the passage called the hateful passage, from the previous region or suburbs of the realms of death into Erebos.

The Styx is properly a fountain in Arcadia, which flows from a rock, and then forms a stream, that continues for a long time buried under ground; its water was mortal, and this circumstance, according to Pausanias, gave occasion to the poets to make it a river or lake in hell. Styx is represented as a torrent, pouring down a precipice, and then as rolling on, to take its course along the boundaries of Aes. On the hither side, the ghosts or souls of the departed are waiting in a crowd, as Virgil (A. vi. v. 306.)
SUA

v. 306.) has described them; and Erebus commences with the bank on the other side of the river. The sole governor of this part, and director of the passage, is Charon, whose dominion lies where the river has recovered itself from the turbulence occasioned by its fall, and begins to become navigable, and who is represented with his boat, both receiving passers, and landing them on the farther shore. Virgil (Ene. vi. 304.) describes him as strong, and in all the vigour and freedom of old age, melancholy, and with a large rude beard, and mattèd grey hair, and his eyes fixed and fiery. He is represented as carrying over the souls of the departed, one freight after another, according to his own pleasure.

STYX, in the Theogony of Hesiod, was the daughter of Oceanus and Tethys. When Jupiter wanted to be avenged of the Titans, and called all the gods to his assembly, Styx was the first that arrived at Olympus, with her fons, which so much pleased Jupiter, that he conferred high honours upon this goddess, loaded her with presents, ordered her name to be used in the inviolable oath of the gods, and kept her children with his. These children were the offspring of the conjunction of Pallas with Styx.

The name of Styx was so terrible, that the most inviolate oath was to swear by Styx, and the gods themselves were very religious in observing it. Those of them who perjured themselves after taking this oath, were very severely punished. The inviolability of this oath was founded upon the ancient custom of using the water of Styx for the trial of the guilty and innocent, and in the manner of the Jews. When the gods swore by Styx, they were to have one hand upon the earth, and the other upon the sea. Iliad. xiv.

STYX, in Geography, a small branch of Patowmack river, where it is called Cohongoronto; it rises in the Laurel Thickets, in the Alleghany mountains, runs north, and discharges itself opposite to Laurel creek.

SUABO, a river of Africa, which joins the Zambeze, S. lat. 18°. E. long. 35° 30'.

SUADI. See SOAD!

SUAGA, a town of Hindooostan, in Bahar; 45 miles N.W. of Chuprah.

SUADA, a town of Arabia, in the province of Hadjas; 25 miles N. of Medina.

SUAKEM, or SUAQUEM, a small island in the Red sea, near the coast of Nubia, with a sea-port of the same name, anciently called "Theon Soter." This island is situated in a bay, the entrance of which is narrow, and well secured from every wind, with five, six, and seven fathoms water. It belongs to the Turks, and is governed by a pacha. The harbour is able to contain 200 ships. The bottom is mud. The ships can come close up to the shore, quite round the town, and may be laden by laying a plank from the warehouses, to the doors of which the galleys are fastened, with the keels stretching over the streets. The trade is very considerable with both the coasts of Africa, the East Indies, Arabia, and Egypt. By nature, the shoals, rocks, landbanks, and intricate channels, rendered it very secure from the attack of an enemy by sea, and it is likewise well fortified. N. lat. 19° 20'. E. long. 35°.

SUAMPETTA, a town of Hindooostan, in Goleconda; 28 miles N.N.W. of Hyderabad.

SUAN, a town of Hindooostan, in Bahar; 8 miles W. of Bahar.

SUANCES, a river of Spain, which runs into the Atlantic, N. lat. 43° 26'. W. long. 5° 59'.

SUAN-YANG, a city of Corea; 33 1/2 miles W. of Tientsin.

Suard, M. in Biography, a man of letters of the old monarchical school in France, a ci-devant member of the Académie des Sciences, possessed of much learning and good taste in all the fine arts. He and his learned friend the abbé Arnaud were the first to décry the music of Lulli and Rameau forty years ago. But charmed with the new music of Gluck, M. Suard became such an intolerant and exclusive partisan for the worthy Teutonic chevalier, that he fell out not only against Piccini and Sacchini, and all the musicians in the German empire, but all the kingdoms and states of Italy.

SUAZREZ, Francis, a Spanish theologian, was born at Granada in the year 1548. He was at an early age distinguished by an extraordinary memory, though his other faculties arrived very gradually at maturity. Having been admitted into the society of Jesuits, he became a professed in the society's schools at Alcala, Salamanca, and Rome, and at length was appointed first professor of theology at Coimbra. He died at Lisbon in 1617, with such resignation and tranquillity, that his last exclamation is said to have been, "I did not think it was so sweet to die." His indefatigable industry may be inferred from the twenty-three folio volumes of his works, which have been printed at Lyons, at Mentz, and, so lately as the year 1748, at Venice. The principal subject of these voluminous publications is theology. Suarez is accounted the principal author of the system denominated "Congruum," fundamentally that of Molina; by which Suarez attempts to explain, from the concurrence of the divine and human being, how grace infallibly produces its effect, without destroying man's free will. Suarez, being a well-known master of controversy, was defended by pope Paul V. to undertake the defence of the Catholic faith in England, where many of that communion took the oath of allegiance required by James I. His book was entitled, "A Defence of the Catholic Faith against the Errors of the English Sect." In discussing the legality of the oath demanded, the principles which he maintained were those of the civil as well as the ecclesiastical supremacy of the papal see. These gave such offence to James, that he ordered the book to be burnt in front of St. Paul's church, and prohibited it to be read in his dominions. The parliament of Paris also caused the book to be burnt by the common hangman, as containing seditious tenets. An abridgment of the works of Suarez, in two volumes folio, by father Noel, a Jesuit, was printed at Geneva in 1732. Moreiri.

SUARIF, in Geography. See Shuarif.

SUARTSAR, a small island on the west side of the gulf of Bothnia. N. lat. 61° 17'. E. long. 17° 7'.

SUATARA, a town on the E. coast of Borsico. N. lat. 3° 55'. E. long. 116° 38'.

SUB, a Latin preposition, equal to hypo, Gr. ὑπό, Ital.; and below, in English. It is frequently used in old music for intervals, and for measure, or proportions of time.

Padre Martini, after giving a long list of Greek, Latin, and Italian indications for bringing in the answer to perpetual fugues, or canons, in his "Saggio di Contrappunto," lays, besides the enigmatical and mythic indications for the solution of canons chief, or close canons, there are two particles in use, sub and supra, below and above; as ad sub dispa- foro, ad sub dispafero, &c. The particle sub implies that the answer ought to be in the octave, or 5th below the subject or guide. The particle supra or supra, lies frequently occurs, which implies an answer above the prejo, or subject; as it seldom happens that a fugue, or canon, is led off by any other than the principal, or highest part in the composition.

The
The Greek equivalents to sub and supra, are hypo and hyper, which mean.

There is a great deal of useful pedantry in explaining the use that is made of sub in the dictionaries of Broilard, and his translator Graffineau, as to measure, or the proportions of time, subiectus terma, tripla, disjunctivum, or measure of three to four, which is marked after the clef, thus: C ; &c. But these explanations are only to be found in old treatises, or in old music not worth decyphering.

The dimensions and measures of triple time, form the use of bars and dots, are so clearly expressed by numbers at the clef, as to want no other explanation. See Measure, and the Modern Time-table.

SUB is also frequently used in composition, in our language.
E.g. SUB-Brigadier, an officer in the horse-guards, who ranks as cornet. See Brigadier.

SUB-Chantor, an officer in the choir, who officiates in the absence of the chantor, &c.

SUB-Decan, an inferior minster, who anciently attended at the altar, prepared the sacred vessels, delivered them to the deacons in time of divine service, attended the doors of the church during communion service, went on the bishop’s embasures with his letters or messages to foreign churches, and was invested with the first of the holy orders.

They were subordinate to the superior rulers of the church, that, by a canon of the council of Laodicea, they were forbidden to sit in the presence of a deacon without his leave. See Deacon.

According to the canons, a person must be twenty-two years of age to be promoted to the order of sub-deacon.

It is disputed among the Romanists, whether the sub-deaconhood be a sacrament or not; in regard sub-deacons are ordained without imposition of hands, and that there is no mention made of them in Scripture. Yet Bellarmin holds the affirmative side of the question.

By the papal canons, a married man may be ordained sub-deacon, upon condition his wife consent to it, make a vow of continence, and shut herself up in a monastery.

SUB-Dam, a dignity in certain chapters beneath the dean.

SUB-Lieutenant, an officer in the royal regiment of artillery and fusiliers, in which are no ensigns, who is the same as second lieutenant. See Lieutenant.

SUB-Marsh, an officer in the Marshalls, who is deputy to the chief marshal of the king’s house, commonly called the knight-marsh, and hath the custody of the prisoners there. He is otherwise termed under-marsh. Crompt. Jurif. 104.

SUB-Prior, a clausural officer, who assist the prior, &c.

SUB-Ploughing, in Agriculture, the practice of running a plough-share through or below the soil, without turning it; and the plough used for this purpose is called a sub-plough.

SUB-Salts, in Chemistry, salts with lefs acid than is sufficient to neutralize their radicals. When a salt is found to contain an excess of acid, the preposition super is generally prefixed to its name. We are indebted, says Mr. Parkes, in his “Chemical Catechism,” to Dr. Pearon for this mode of distinguishing these salts.

SUB-Soil, in Agriculture, a term often applied to the intervening bed or stratum of earthy or other matters, which lies between the surface-soil, and the base or sub-stratum on which the whole rests. This is very uncertain in regard to its depth in most cases. In some instances, as where the uncultivated part of the earth or land rests or is placed on rock or rocky matter, it may be said, it is supposed, to be wanting; though, in most cases of this nature, a stratum or bed of a gravelly kind, mostly constituted of broken rock and earth, is found between them. And in a variety of cases, a regular bed of gravel, sand, or other similar earthy material, intervenes between the soil and the base or sub-stratum; while in still other instances, a somewhat uniform make of earthy materials reaches to a great depth, and, of course, if any definite depth or thickness of sub-soil is given to it, it must be arbitrary and uncertain in some degree or more.

The nature of the sub-soil, as well as the bases on which it rests, has also very great influence on the productiveness of the land. See Soil.

SUB-Soil Arched Main-Drain, such a drain as has a sort of arch turned over it in maon’s work. These drains are in general much too expensive to be employed in any situation, except as large discharging drains, where the ground is loose and porous, or where open drains cannot be admitted, as in pleasure-grounds, or to convey off water from deep wod-rains. When it comes to the flat kind, it can be readily obtained, these sorts of drains may be formed of them, especially where the quantity of water is not too great.

SUB-Soil Brick-Drain, that sort of deep, under-soil drain which is formed or laid with common or other kinds of bricks, or with some similar kind of materials, in a perfect manner. It is almost always in use for spring-draining. See Spring-Drain.

SUB-Soil Covered Drain, such a drain as is formed in the under-stratum of the land, and which should constantly vary according to the nature of it, and that of the materials which the particular situation affords. These sorts of drains are either hollow or filled, according as they are to receive the water, and the nature of the materials of which they are to be constructed. Moles are the greatest enemies of these drains, especially where their operations arise near the surface. These natural drainers of foils (and valuable labourers in old graslands) require, it is conceived, outlets to their drains, to discharge the rain-water which the foil communicates to their runs; otherwise they would be liable to be drowned in their own works, or to be driven from them, in a wet season. When we see, it is found, if open drains, ditches, and rilles, pierced with mole-holes. Covered drains are equally favourable to their purpose; and doubtless are in common use, where moles inhabit the sub-drained lands.

There is another source of injury in field-mice to filled drains. They not only, it is said, molest against them, in the manner of moles, but make their lodgings, it is apprehended, among the rough, open materials.

SUB-Soil Hollow Drain, such a drain as is formed in the under foil without being filled. It is observed by a late writer, that in cases where the water is to enter the drain at its base, as in that of rising waters, hollow drains are preferable to those which are filled, especially where the bore has been used; as the water immediately finds an open channel to receive it. Mr. Elkington recommends, in difficult cases at least, to bore by the side of the drain, not in the middle of the floor. If the bottom of a drain, which is perforated on the side, were made hollow, or diluting, not flat, the mouths of the bores would be out of the way of the current of the water. If the bottom of a drain be not firm enough to sustain the current, common pantiles would make an eligible floor for a perforated trench. And it is added, that where the drain is to collect the water at its sides, from the stratum in which it is formed, a depth of absorbent materials may be required; and here drains of lye expense will generally answer the de-
to be received, the two kinds may be profitably united in
many instances, it is supposed.
But these sorts of drains may be formed in different ways,
and of various materials. When constructed of stone, it has
been rated by Mr. Marshall, that in districts where thin, flat
stones are abundant, and in caves where the sub-soil is deep, and
of a loose, friable texture, fissure-walled drains, formed
with wide flat stones laid at the bottom, a dry wall raised on
each side with the refuse splinters of the same rock, and co-
verted with flat stones at the top, are eligible.
It is remarked, that in Devonshire, where thin flat stones
and rough pebbles are equally plentiful, it is common to
place the former, trianglewise, at the bottom of the trench,
and then to fill in, above, with the latter; thus forming, at
a moderate expense, a drain that is equally adapted to waters
rushing at the base and thole which are collected from the sub-
soil. They are much firmer, and less expensive, than the
more common square drains that are formed with two side-
stones, set on edge, and a wide, flat, covering stone, which
is an unstable fabric, compared with a triangular drain.
It is further stated, that hollow drains may also be made of
common bricks, but generally at a great cost. This has led
to the invention of draining-bricks of various forms. And
in a country where clay is plentiful, and stones are scarce,
they may be profitably used. In places where manufactur-
aries of draining-bricks are not established, and where the
length of drains required is not great, a flooring of common
plain tiles, and, along these, a line of common ridge-tiles,
would form an efficient channel for almost any purpose
of working-drains. Where water is to be collected from a sub-
soil, which, though absorbent, parts with its superfluous mois-
ture reluctantly, and where pebbles are wanting, a covering of
clean rough gravel, or other hard and open materials, would
be found useful in this, as in every other species of hollow
drainage. See Spring-Drain.
SUBAH, or Sourah, a term used in India as synoni-
mous with province. See CIRCAR.
Accordingly, Subadar, or Suboddar, denotes the governor
of a province: the term is also applied to a black officer,
who ranks as captain in the Company's troops, but ceases to
have any command when an European officer is present.
SUBALTERN, formed from sub and alter, another, an
inferior officer, or one who discharges his post under the com-
m mand, and subject to the direction of another.
Such are lieutenants, sub-lieutenants, cornets, and ensigns,
who serve under the captain.
We also say, subaltern courts, jurisdictions, &c. Such
are those of inferior lords, with regard to the lord para-
mount; hundred-courts with regard to county-courts, &c.
For the subaltern persons in an epic poem, F. Boiss ob-
serves, there is no necessity to be very strict: in preferring
every one's character.
The patriarchs, M. St. Evremont tells us, had several
wives, who did not all hold the same rank; but there were
several subalterns to the principal wife.
SUBALTAR GENUS. See GENUS.
SUBAPOUR, in Geography, a town of Bengal; 40
miles N.N.E. of Ilamabad.
SUBARKAN, a town of Asiatic Turkey, in the go-
vernment of Diarbekir, on the Euphrates; 75 miles E.S.E.
of Kerkisch.
SUBARMALE, among the Romans, a coarse and thick
kind of cascof cloth worn by the soldiers under their arms, in
order to keep them from being hurt with their weight.
SUBBRA, in Geography, a town of Bengal; 20 miles
W. of Rogouaptour.
SUBBUTEO, in Ornithology, the name of a bird of the
hawk kind, called in English the ringtail; the male of which
has been supposed to be the hen-barrier. Some authors
give it the name of Bocypterus acutipennis. See Boardy.
SUBCLAVIAN, in Anatomy, the great arterial and
venous trunks belonging to the upper extremity. See Ar-
tery and Vein.
SUBCLAVIAN Anencephaly, in Surgery. For an ac-
count of the recent operations for their cure, we refer to the article Subcutaneous.
SUBCLA VIUS, (sulco-clavicular,) in Anatomy, a small
muscle, lying, as its name implies, under the clavicle. It is
narrow and elongated, and reaches from the under surface of
the clavicle, where it arises by tendinous and fleshly fibres,
obliquely to the cartilage of the first rib, in which it is in-
serted by a strong tendon. The pectoralis major covers it
in front; also a thin aponeurosis extending from the edge
of the clavicle: behind, it covers the axillary vessels and
brachial plexus. Its upper edge is attached to two-thirds
of the under surface of the clavicle, towards the scapula; in
front, this edge is free. The lower edge is also free. The
outer extremity is pointed, and forms the commencement
of its origin from the clavicle: the inner end is larger, and
terminates on the cartilage of the rib in front of the sulco-
clavicular ligament.
It will deprive the clavicle to the chef, and restore it
after it has been carried either forwards or backwards.
The clavicle being fixed, it may render firm the first rib.
SUBCONTRARY Position, in Geometry, is when two
similar triangles are so placed, as to have one common
angle, O, (Plate XV. Geometry, fig. 1.) at their vertex, and
yet their bases not parallel.
If the scalene cone A B L C K be so cut by the plane
DIEH, as that the angle at E = B, the cone is then said to be cut subcontrarily to its base B C; and in this
case the section DIEH will be a circle.
For, through the vertex A and centre of the base, let
the triangular section A B C be taken, so as to be at right angles to the planes of the base B K C L of the subcon-
trary section DIEH, and of the section F I G H taken
parallel to the base, and cutting the subcontrary section in
the line I O H; consequently, I O H is perpendicular to D E and F G, intersecting another one in O. The section
F I G H, parallel to the base of the cone, is a circle; therefore
F O \times O G = O I ^ { 2 } ; and the triangles G O E
and F O D having G E O = A B C = D F O, and
G O E = D O F, are similar; therefore E O : O G :: F D
: D O, and E O \times D O = F O \times O G = O I ^ { 2 } ; con-
sequently, O I is a mean proportional, either between FO
and O G, or D O and E O; and as the same would happen
wherever F G cuts D E, all the lines O I, both in the
sections F I G H, and D I E H, are lines in a circle; con-
sequently the section D I E H is a circle.
SUBCOSTAL, in Anatomy, a name given by Winflow
to the internal intercostal muscles. See Intercoastales.
SUBDARUPOUR, in Geography, a town of Hind-
doofan, in Bahar; 23 miles N. of Durbungah.
SUBDIVISION, in a general sense, denotes a second
division of any whole. In a military sense, a company is
said to form two subdivisions; whereas two companies
added together make a grand division; except the flank
companies, which of themselves constitute grand divisions.
SUBDOMINANTE, in Music, is a name given by M.
Rameau to the fourth note of the tone, because the domi-
nant is immediately above it, or rather because it has the
same interval of the tonic in descending, as the dominant
has in ascending.
SUBDUCTION, in Arithmetica, the same as subtraction.
3 H  SUBDU
SUBDUPLE RATIO, is when any number or quantity is contained in another twice. Thus 4, is said to be subduple of 2, as 8 is of 3. See RATIO.

SUBDUPPLICATE RATIO of any two quantities, is the ratio of their square roots.

SUBER, in Botany, the ancient Latin name of the Cork Tree, of obscure and doubtful derivation. (See Quercus, fp. 33.) It may not be amiss here to observe that in the famous Æneas, under fp. 37 and 55, Mount Athos is by accidental mistake put for Mount Atlas; and that the latter species, Q. Pseuda-cocceifera, is described and delineated in Labillardiere's Planta Syria, falc. 5. t. 6.

SUBER Montanum. See Cork, Foiil.

SUBERATES, in Chemistry, salts formed by the combination of any base with the fuberic acid. These salts may be generally described as possessing a bitter taste, and being decomposable by heat. The principal suberates are those of barytes, of potash, of lime, and of ammonia. The suberates, which are all volatile, are more or less soluble; some readily, and others with difficulty, crystallize. Some remain pulverulent, whilst others are deliquescent. The mineral acids decompose these salts, and precipitate from their solutions the fuberic acid, which separates in the crystallized form. None of these salts are yet come into use.

SUBERIC ACID, an acid prepared from cork by means of pitric acid. (See Acid of Cork.) It was discovered by Brugnatelli in the year 1787, and he gave it the name fuberic from fuber, the cork-tree. He has noticed, that this acid may be obtained in considerable quantities from paper, by treating it with nitric acid. Its taste is acid: it is generally seen in the state of powder, and is not crystallizable. Boiling water dissolves half its weight, but it is very insoluble in cold water. Parker's Chem. Catechism.

SUBETH, the word used by the Arabian writers to express a carus.

SUBETH Sabala, a term used by the Arabic writers to express a coma vigil.

SUBHAVATI, in Hindu Mythology, the name of the court or terrestrial paradise of the Hindu Neptune, who is called Varuna; which see. It is described in the Purana as situated far in the west; Varuna being guardian of that region.

SUBIACO, in Geography, a town of the Campagna di Roma; 28 miles E. of Rome.

SUBIANO, a town of Etruria; 7 miles N. of Arezzo.

SUBJECT, Subditus, a person under the rule and dominion of a sovereign prince or state.

Of subjects, some are by birth, others become so by aea of naturalization.

Anciently the lords called, abusively, those who held lands or fees of them, or owed them any homage, their subjects.

Subject, Subiectum, is also used for the matter of an art or science, or that which it considers, or on which it is employed. Thus, the human body is a subject of medicine.

In this sense anatomists call the body they are dissecting, and upon which they read lectures, their subject.

The subject of logic is thinking, or reasoning; but more particularly a syllogism, one of the terms of a proposition is called the subject, and the other the attribute.

In poetry, the subject is the matter treated of, or the event related, or set to view, and enriched with ornaments.

Subject also denotes the substance or matter to which an accident is added.

It is a maxim, that two contraries can never subsist in the same subject.

Subject, in Music, a series of notes at the beginning of a movement in the principal part, which serves as a text or theme, and which should not long be forgotten; as this first idea should give birth to all the rest. (See Design.) All the other parts require only art and labour in filling them up. But the principal melody depends on genius, and it is that alone which manifests invention. The principal subjects in music produce airs of many kinds. Canons, fugues, and imitations, are constructed on a few bases, and often on a few notes, which are so repeated after each other in the several parts, from the beginning to the end of the movement; in canons, rigorously in the same intervals; in free fugues, rigorously only at the beginning, in the answers; and imitations may be made in any intervals of notes that recall us of the passage to be imitated.

In writing upon canto fermo, and in elaborate counterpoint, the parts are frequently changed, and the subject, or canto fermo, sometimes given to one part and sometimetime to another, is called double counterpoint. (See Counterpoint.) These are very artful expedients for佟n coitus fugues. But the time for gaining fame and admiration in music by mere labour is over. Imagination has taken wing, and her flights and meanders, if accompanied by grace, are sure to be eagerly followed by every judge of the art; as these flights, if not too wild and capricious, need not preclude ingenuity and contrivance in the subordinate parts. A cold and barren composer, after having, with difficulty, found a mean and infipid subject, only transposes and repeats it in all the warrantsable keys; but a great master, full of fire and imagination, without suffering the subject to be forgotten, gives it, either by the accompaniment, or by some little change or grace, a new countenance every time he repeats it. And here we cannot in justice withhold our admiration at the ingenious and delightful manner in which Haydn and Mozart adhere to the spirit of their subiecta, without dull and monotonous iteration.

SUBJECTION, Subjectio, in Rhetoric. See Hyperbole.

SUBJECTION, Civil, in Law. See Civil Subjection.

SUBJECTIVE Part. See Part.

SUBINFEUDATION, in Law, was where the inferior lords, in imitation of their superiors, began to carve out and grant to other ministeri etates than their own, to be held of themselves, and were so proceeding downwards as infeudation, till the superior lords observed, that by this method of subinfeudation they lost all their feudal profots of wardships, marriages, and etfrates, which fell into the hands of these menfe or middle lords, who were the immediate superiors of the terre-tenant, or him who occupied the land. This occasioned the statute of quia empress. Bl. Com. vol. ii.

SUBINTRANTES FERRES, a term used by some medical writers to express those fever in which one fit begins before the other is perfect, or worn off.

SUBITO, Italy, immediately, without loss of time: as voli fubito, turn over quick

SUBJUNCTIVE, in Grammar, the fourth mood, or manner of conjugating verbs, thus called, because usually subjoined to some other verb, or at least to some other particle, as, if I loved: though this were true, &c.

The Greek is almost the only language that properly has any subjunctive mood; though the French, Spanish, and Italian,
Italian, have some show of it. In all other languages, the same inflections serve for the optative and the subjunctive moods; for which reason the subjunctive mood might be retrenched from the Latin, and those other grammars; because they are not the different ways of signifying, which may be very much multiplied, but the different inflections, that constitute the different moods. See Mood.

SUBLAPSARIAN, or Infralapsarian, in Theology, a term applied to faith as held that God, having foreseen and permitted the fall of Adam, and, in consequence of it, the loss of mankind, resolved to give a grace sufficient for salvation to some, and to refuse it to others.

Sublapsarian is used as synonymous with Infralapsarians, in opposition to Supralapsarian.

SUBLICIUS POMA, in Ancient Topography, one of the eight bridges over the Tiber at Rome. This was the first bridge that was built at Rome: it was constructed by Ancus Martius, entirely of oak wood; Ovid calls it Robornus. On this bridge the Roman Horatius Cocles kept at bay the whole army of the Tuufens, commanded by Porfenans; and from hence also the dead body of Heliogabalus was thrown into the Tiber. It crossed the Tiber from the foot of mount Aventine, to the spot here called prata Mutia, and led towards Etruria. A sudden inundation broke down this bridge, in lieu of which the pretor Emilius Lepidus built one of stone; when this was destroyed by the swelling of the water, the emperor Tiberius constructed another of stone; and when this was destroyed by the same means, the emperor Antonius Pius built a new one of marble, more lofty than the former. But this also has been demolished by the overflowing of the Tiber, so that only few remains of it are to be perceived, near the banks and under the water.

SUBLIMABLE BODIES, a term used by some of our chemical writers to express such substances as are capable of sublimation in a dry form.

SUBLIMATE, a chemical preparation, the basis of which is mercury or quicksilver. See Mercury.

SUBLIMATION, a chemical operation, by which volatile and solid substances are collected and obtained, and differs little from distillation, excepting that, in distillation only the fluid parts of bodies are raised; but in sublimation the solid and dry; and that the matter to be distilled may be either solid or fluid; but sublimation is concerned only about solid substances. There is also another difference, namely, that rarefaction, which is of very great use in distillation, has hardly any room in sublimation; for the substances which are to be sublimed, being solid, are incapable of rarefaction, and so it is only impulse that can raise them.

However, it may not be improper to inquire a little more nicely into the reason of such a diversity in the elevation of bodies; why some do ascend with a gentle heat, and others are not to be raised by the most vehement fire; and such an inquiry will more properly come in here, because this head contains all the business of volatility and fixation.

The cause of this elevation and ascent in the particles of bodies, is to be ascribed to the fire, not only on account of impulsion, but of another property the fire has, namely, to infuse itself into all the interstices of these bodies, and thereby break the cohesion of their parts, so that at last they become divided into very small parts, if not into the smallest that art can reduce them into.

Particles, thus separated and divided, lose much of their gravity. For the gravity of the same particle decreases in the same proportion as the cube of the diameter is lessened. Suppose, therefore, a body, whose diameter is 12; if, then, its diameter be made less by 1, viz. 11, the gravity of that body will be only 94, or thereabouts; a body, therefore, by being divided into very minute corpuscles, becomes easy to be sublimed.

And, indeed, that the surface of the body decreases in a very different manner from gravity, only as the square of the diameter is lessened. Where the gravity decreases in such a series, as is expressed by the numbers 12, 13, 1000, the diminution of the surface will observe this proportion; viz. 114, 121, 100; and when, upon reducing the diameter to 6, the gravity becomes less than 2, the surface will still amount to 36.

How much this contributes to a quick ascent, will appear from the sublimation of camphor, benzoin, and arsenic; whose particles, as they cohere but loosely, are, for this reason, diffused into a larger surface; upon which account they are the easiest to be sublimed of any; nay, these solid particles, upon account of their surface, will sooner ascend than many fluids.

So flower of sulphur rises sooner than oil, not only than that of vitriol, but any other, though ever so light.

By this contrivance of nature, viz. that the gravity of bodies decreases in a triplicate, but their surface in a duplicate proportion of their diameters, it comes to pass that bodies, which have a very different gravity, may be raised with the same force. Thus the salts of animals, as of hart-horn, human blood, that of vipers, &c. being composed of very minute corpuscles, as is found by experience, in diffusing them, do easily ascend, because the surface in them is not lessened so much as gravity is; and the salts of vegetables, as of tartar, bismuth, &c. which are of a more clese texture, by reason of their larger surfaces, are also without much difficulty raised.

The corpuscles also of minerals and metals, though very compact and heavy, do, in some measure, give way to the fire, and are capable of being sublimed. In all these instances, the breadth of the surface, which expouses the particles more to the impetus of the fire, is the reason why they are raised with so much ease as if their gravity had been diminished by diminishing their surface; so that particles, though ever so different in weight, may be equally raised by the same degree of heat, if the proportion of their gravity be reciprocal to that of their surfaces.

Sublimation is employed to separate volatile substances from
from others which are fixed or less volatile, to combine two volatile matters, as in the operation of the sublimates of mercury, and to collect some volatile sublimes, as leaded salt, sulphur, and all the preparations called flowers.

The apparatus for sublimation is very simple. This process is conducted sometimes in a crucible, with a cone of paper or another crucible inverted over it, in which the process is continued; and as in this case it is light and pungent, it was formerly named "flowers." A matras or small alembic is generally sufficient for the sublimation of small quantities of matter. But the vessels, and the method of managing the fire, vary according to the nature of the matters that are to be sublimed, and according to the form which the sublimate is to receive. When the matters to be sublimed are volatile, a high cucurbit, to which is adapted a capital, and even several capitals placed one upon another, are to be employed. The sublimation is performed in a sand-bath, with only the precise degree of heat requisite to raise the sublimate which is to be sublimed, and the capitals are to be guarded as much as possible from heat.

When along with the dry matter, which is to be collected in these sublimations, a certain quantity of some liquor is raised, as in the sublimation of leaded salt, and rectification of volatile concrete alkalies, a paffage and a receiver for these liquors must be provided, which is conveniently done by using the ordinary capital of the alembic, furnished with a beak and a receiver.

Some sublimates are required to be in as solid and compac safe as their nature will allow, as camphor, sal ammoniac, and all the sublimates of mercury. The most proper vessels for these sublimations are bottles or matrassefs, which are to be sunk more or less deeply in sand, according to the volatility and gravity of the matters that are to be sublimed. The art of conducting these sublimations consists in applying such a degree of heat, or in so disposing the sand, (i.e. making it cover more or less of the matrassefs,) that the heat in the upper part of the matrassefs shall be sufficient to make the sublimate adhere to the glass, and to give it such a degree of fusion as is necessary to render it compac, but not a heat so great as to force the sublimate through the neck of the matrassefs, and disrupt it.

Many sublimates may be reduced into flowers and sublimed, which cannot be sublimed in close vessels, but require a very great heat, with the access of free air, and even the contact of coals: such as moist foots or flowers of metals, and even some saline sublimes. The matters from which these sublimates are separated, must be placed among burning coals in open air, and the flowers are collected in the chimney of the furnace in which the operation is performed. This process is called sublimation in the manner of Geber. Of this kind of sublimates are the turity, calamine, or pompholix, gathered in the tops of furnaces in which ores are smelted. Macquer’s Dict. Chem. Eng. edit. art. Sublimation.

SUBLIME, in Dicouerfs, something extraordinary and surprizing, which strikes the foul, and makes a sentiment or composition ravish and transport.

This is what Longinus, who has written expressely on the subject, means by sublime. The definition, indeed, is not his, but M. Boileau’s; for the author, writing his book after another of Cecilius on the fame subiect, and employing himself almost wholly in fiewing what the sublime is, declined defining it, as supposing it well known.

By the definition it may appear, that the sublimate is a very different thing from what the orators call the Sublime Style; which see. See also Sublimity.

SUBLIMING GEOMETRY. See GEOMETRY.
SUBLIMITY.

Give me your weighty secrets to display,
From those black realms of darkness to the day.”

Pitt.

"Obscure they went; through dreary shades, that led
Along the waite dominions of the dead;
As wander travellers in woods by night,
By the moon’s doubtful and malignant light.”

Dryden.

Obscurity is not unfavourable to the sublime; for though it render the object indistinct, the impression, however, may be great; the imagination being strongly affected by objects of which we have no clear conception. Thus we see, that almost all the descriptions that are given us of the appearances of supernatural beings carry some sublime, though the conceptions they afford us be confused and indistinct. This sublimity arises from the ideas, which they always convey, of superior power and might, joined with an awful obscurity. (See Job, iv. 15.) Thus also, the picture which Lucretius has drawn of the dominion of superintuition over mankind, representing it as a portentous spectre sweeping its head from the clouds, and dismembering the whole human race with its countenance, together with the magnanimity of Epicurus in raising himself up against it, carries all the grandeur of a sublime, obscure, and awful image:

“I humanae ante oculos fade cum vitae jacet in terris, oppressa gravi sub religione, Quae caput a coeli regionibus offendebat, Horribilis super specus mortalibus infrans, Primum Graius homo mortales tollere contra Erit oculos auras.”

Lib. i.

In general, all objects that are greatly raised above us, or far removed from us, either in space or in time, are apt to strike us as great. Moreover, disorder, as well as obscurity, is very compatible with grandeur, and even frequently heightens it. Few things that are strictly regular and methodical appear sublime. In the freble attempts which human art can make towards producing grand objects, greatness of dimensions always constitutes a principal part. No pile of building can convey any idea of sublimity, unless it be ample and lofty. Thus, a Gothic cathedral raises ideas of grandeur in our minds, by its size, its height, its awful obscurity, its strength, its antiquity, and its durability.

The author, whose observations on this subject we are now citing, mentions another class of sublime objects, which may be called the moral, or sentimental sublime; arising from certain exertions of the human mind, from certain affections and actions of our fellow creatures. These may be referred to that class, which is distinguished by the appellation of magnanimity or heroism; and they produce an effect very similar to that which is produced by the view of grand objects in nature; filling the mind with admiration, and elevating it above itself. Of this sentimental sublime, we are furnished with instances in the famous contest between the Horatii and the Curati (see Curiaii); in the case of Porus and Alexander and all of Cesar, mentioned under the article Sublime Style. High virtue is the most natural and tender source of this moral sublimity. It has been a subject of enquiry, whether there be any one fundamental quality in which all the different objects above-mentioned, and others of a like kind, agree, and which is the cause of their producing an emotion of the same nature in our minds? The ingenious author of “A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful,” has proposed a formal theory for the solution of this question. According to Mr. Burke, terror is the source of the sublime, and, in his opinion, no objects have this character but such as produce impressions of pain and danger. But Dr. Blair thinks, that, although many terrible objects are highly sublime, the author now mentioned has stretched his theory too far, when he represents the sublime as consisting wholly in modes of terror, or of pain. For the proper sensation of sublimity appears to be very distinguishable from the sensation of either of these; and on several occasions to be entirely separated from them. In many grand objects, there is no coincidence with terror at all; and in many painful and terrible objects, there is no sort of grandeur. Dr. Blair inclines to think, that mighty force or power, whether accompanied with terror or not, whether employed in protecting, or in alarming us, has a better title than any thing that has yet been mentioned to be the fundamental quality of the sublime, as no sublime object occurs to him, into the idea of which power, strength, and force, either enter indifferently or are not, at least, intimately associated with the idea, by leading our thoughts to some astonishing power, as concerned in the production of the object.

Before we close our account of sublimity, as it respects external objects and mental or moral qualities, we shall flow a few words on the difference between sublimity and beauty. The pleasure afforded by the contemplation of beauty appears to be a pure and unmixed pleasure, but it is less vivid than that which is produced by the sublime. As for the latter, often borders upon terror, it requires a greater exertion, and produces a stronger, though less durable sensation, than the beautiful. The sublime also differs from the beautiful, in being only conversant with great objects; and it differs from the pathetic, in affording a more tranquil pleasure.

Sublimity in discourse or writing, understood in its most extensive sense, is not merely that sublimity which exhibits great objects with a magnificent display of imagery and diction, but that force of composition, whatever it be, which excites the passions, and which expresses ideas at once with perplicivity and elevation, not licentious whether the language be plain or ornamented, refined or familiar. This is the sense in which Longinus uses the word; and he points out five sources of this sublimity; and of these, as we have already observed under the article Sublime Style, Dr. Blair allows only two to have any peculiar relation to the sublime. The sublime consists either in language or sentiment, or more frequently in an union of both, since they reciprocally affect each other, and since there is a necessary and indissoluble connection between them. The foundation of the sublime in composition must always be laid in the nature of the object described. Besides, the object must not only be sublime itself, but it must be so exhibited, as to give us a clear and full impression of it. For this purpose, it must be described with strength, conciseness, and simplicity. It is observed, that the early ages of the world, and the rude unimproved state of society, are peculiarly favorable to the strong emotions of sublimity; in such circumstances the genius of men is much turned to admiration and astonishment. Among ancient authors we are the most likely to find striking instances of the sublime; and more of these occur in the sacred scriptures than in any other writings, ancient or modern. In the preceding part of this article we have noticed the descriptions which they afford us of the Deity; descriptions that are wonderfully noble, both on account of the grandeur of the object, and the manner of repre-
reposing it. (See Piae xvi. 6, 8c. Habakkuk, iii. 6. 10. See also the passages cited by Longinus from Moses, Gen. i. 3, and Isaiah, xiv. 24, 27, 28.) Under this head we may mention another passage in Pl. lxxv. 1, "God filleth the noise of the seas, the noise of their waves, and the tumults of the people." For a variety of other passages that occur in the sacred writings, selected by the learned bishop Lowth as specimens of sublimity both of sentiment and language, we refer to his Lectures on the Sacred Poetry of the Hebrews. Homer has been admired in all ages, and by all critics, for sublimity, much of which he owes to that native and unassailable simplicity which characterizes his manner. His description of his hero, especially when he speaks, is a mere abstraction, the fire and rapidity, which he throws into his battles, present to every reader of the Iliad, frequent instances of sublime writing. His introduction of the gods tends often to heighten, in a high degree, the majesty of his warlike scenes. Hence Longinus bestows such high and just commendations on that passage, in the 15th book of the Iliad, where Neptune, when preparing to issue forth into the engagement, is described as flashing the mountains with his feet, and driving his chariot along the ocean. Minerva, arming herself for fight in the 5th book, and Apollo, in the 15th, leading on the Trojans, and flashing terror with his aegis on the face of the Greeks, are familiar instances of great sublimity added to the description of battles, by the appearances of those celestial beings. In the 20th book, where all the gods take part in the engagement, according as they severally favour either the Greeks or the Trojans, the poet's genius is signally displayed, and the description rises into the most awful magnificence. All nature is represented as in commotion: Jupiter thunders in the heavens; Neptune strikes the earth with his trident; the ships, the city, and the arms of the enemy, all tremble to its centre; Pluto flits from his throne, in dread lest the secrets of the infernal regions should be laid open to the view of mortals. The works of Offian also abound with instances of the sublime. From the various examples produced by Dr. Blair he is justified in maintaining, that simplicity, as opposed to studied and profuse ornament, and conciseness, as opposed to superfluous expression, are essential to sublime writing: and our author states the reason why a defect in either of these qualities is peculiarly hurtful to the sublime. The emotion which he says, that is occasioned in the mind by some great or noble object, raises it considerably above its ordinary pitch, and produces a sort of enthusiasm, which is very agreeable while it lasts, but from which the mind is tending every moment to fall down into its ordinary situation. When an author has brought us, or is attempting to bring us, into this state; if he multiplies words unnecessarily, if he decks the sublime object, which he presents to us, round and round with glittering ornaments; nay, if he throws in any one decoration that sinks in the leaf below the capital image, that moment he alters the key; he perplexes the tension of the mind; the strength of the feeling is emaculated; the beautiful may remain, but the sublime is gone. Hence our author concludes, that rhyme, in English verse, is unfavourable to the sublime, if not inconsistent with it. Homer's description of the nod of Jupiter, as flashing the heavens, has been admired in all ages, as highly sublime. Literally translated, it is as follows: "He spoke, and bending his fable brows, gave the awful nod; while he shook the celestial locks of his immortal head, all Olympus was shaken." Mr. Pope, in the subjoined translation, spoils the image, and attempts to beautify it; but, in reality, weakens it.

"He spake; and awful bends his fable brows,
Shakes his ambrosial curls, and gives the nod,
The stimp of fate, and sanction of a god.
High heaven with trembling the dread signal took,
And all Olympus to its centre shook."

Blank verse, by its boldness, freedom, and variety, is much more favourable than rhyme to all kinds of sublime poetry. Milton, whose genius led him eminently to the sublime, has fully proved this assertion. The whole first and second books of Paradise Lost are continued instances of it. As an example, we may cite the following description of Satan, after his fall, appearing at the head of the infernal host:

"He, above the reef,
In shape and gesture proudly eminent,
Stood like a tower: his form had not yet loft
All her original brightness, nor appeared
Less than archangel ruined; and the excess
Of glory obscured. As when the sun, new risen,
Looks through the horizontal misty air,
Shorn of his beams; or, from behind, the moon,
In dim eclipse, diffracted twilight sheds
On half the nations, and with fear of change
Perplexes monarchs. Darken'd fo, yet home
Above them all th' archangel."

Befide conciseness and simplicity, strength is another essential requisite of sublime writing. The strength of description arises, in a great measure, from a simple conciseness; and it also supposes a proper choice of circumstances in the description, so as to exhibit the object in its full and most striking point of view. A storm, or tempest, is a sublime object in nature; but to render it sublime in description, it must be painted with such circumstances as fill the mind with great and awful ideas; as Virgil has done in the following passage (Georg. i.), which we shall give in Dryden's translation:

"Ipse Pater, &c."

"The father of the gods his glory throngs,
Involv'd in tempests, and of clouds:
And from the middle darkness flashing out,
By fits he deals his fiery bolts about,
Earth feels the motions of her angry God,
Her entrails tremble, and her mountains nod,
And flying beasts in forests seek abode.
Great deeps seizes every human breath;
Their pride is humbled, and their fears confest;
While he, from high his rolling thunders throws,
And fires the mountains with repeated blows;
The rocks are from their old foundations rent,
The winds redouble, and the rains augment."

Every circumstance, says Blair, in this noble description, is the production of an imagination heated and enthralled with the grandeur of the object. The proper choice of circumstances in a sublime description has such a foundation in nature, that the least deviation from it is fatal. This is owing to the nature of the emotion aimed at by sublime description, which admits of no mediocrity, and cannot subsist in a middle state, but must either highly transport us, or, if unsuccessful in the execution, leave us greatly disgusted, and displeased. Thus, when Milton, in his battle of the angels, describes them as tearing up the mountains, and throwing them at one another; there is, in his description, as Mr. Addison has observed, no circumstances that are not properly sublime.

"From
**S U B**

« From their foundations loosing to and fro,
The planked the seated hills, with all their load,
Rocks, waters, woods; and by the flabby tops
Uplifting, bore them in their hands.»

If it be enquired, what are the proper sources of the sublime? the answer is, that they are to be looked for everywhere in nature. It is not by hunting after tropes, and figures, and rhetorical affinities, that we can expect to produce it. It must come unfought, if it come at all; and be the natural offspring of a strong imagination.

« Eft Deus in nobis; agitate calecitmus illo.»

In judging of any striking beauty in composition, whether it is, or is not, to be referred to this class, we must attend to the nature of the emotion which it raises; and only, if it be of that elevating, solemn, and awful kind, which distinguishes this feeling, we can pronounce it sublime. Hence, it follows, that it is an emotion which can never be long protracted. The utmost we can expect is, that this burst of imagination should sometimes flash upon us like lightning from heaven, and then disappear. In Homer and Milton, this effulgence of genius breaks forth more frequently, and with greater lustre than in most authors. Shakespeare also riffs often into the true sublime. But no author is sublime throughout. In a limited sense, however, there are some, who merit the name of continued sublime writers; and in this class we may justly place Democritus and Plato. In all good writing, the sublime lies in the thought, not in the words; and when the thought is truly noble, it will, for the most part, clothe itself in a native dignity of language. The main secret of being sublime is to say great things in few and plain words. The most sublime authors are the simplest in their style. If a writer affects more than ordinary pomp and parade of words, and endeavours to magnify his subject by epithets, you may immediately suspect, that, feeble in sentiment, he is struggling to support himself by mere expression. See **Sublime Style**.

**SUBLINGUAL.** In Anatomy, a branch of the lingual artery. (See Artery.)—Also, one of the salivary glands. See **Dilatation**.

**SUBLINGUAL.** Prim. See **Ranini**.

**SUBLUXATIO.** In Surgery, a violent sprain; also, an incomplete dislocation.

**SUBMARINE NAVIGATION.** See **Submarine Navigation**.

**SUBMISSION, Submersio.** See **Drowning**.

**SUBMULTIPLE.** In Geometry, &c. A submultiple number, or quantity, is that which is contained a certain number of times in another, and which, therefore, repeated a certain number of times, becomes exactly equal to it.

Thus, 3 is a submultiple of 21. In which case a submultiple coincides with an aliquot part.

**SUBMULTIPLE Ratio.** Is that between the quantity contained, and the quantity containing. Thus, the ratio of 3 to 21 is submultiple.

In both cases, submultiple is the reverse of multiple: 21, e. gr. being a multiple of 3, and the ratio of 21 to 3 a multiple ratio.

**SUBMULTIPLE Subhyperparticular.** See **Ratio**.

**SUBMULTIPLE Subsimplex.** See **Ratio**.

**SUBNORMAL, or Subperpendicular, in Geometry.** A line which determines the point in the axis of a curve, where a normal or perpendicular, raised from the point of contact of a tangent to the curve, cuts the axis.

Or, the subnormal is a line, which determines the point in which the axis is cut by a line falling perpendicularly on the tangent in the point of contact.

Thus, TM (Plate XV. Geometry, fig. 2.) being a tangent to a curve in M; and MR a normal or perpendicular to the tangent; the line PR, intercepted between the semidiameter PM and the normal MR, is called the subnormal.

Hence, 1. In a parabola, as AM, &c. the subnormal PR is to the semidiameter PM, as PM is to PT, and as MR to TM.

2. In a parabola, the subnormal PR is subduplicate the parameter; and consequently it is an invariable quantity: for

\[
PR = \frac{PM^2}{PT} = \frac{PM^2}{2AP} = \frac{\rho}{\alpha^2}
\]

In general, the subnormal may be found by dividing the square of the semidiameter by the sub-tangent.

**SUBOCCIPITAL, in Anatomy, the pair of nerves which run out between the occiput and atlas; they are the tenth pair of the head of some anatomists, but are now usually called the first cervical pair. See **Nerve**.

**SUBORBITAR, the foramen near the inferior edge of the orbit, and the artery and nerve which occupy that foramen. See **Canum, Artery, and Nerve**.

**SUBORDINATED, and Subordinating Affections.** See **Affections**.

**SUBORDINATION, a relative term, expressing the degree of inferiority between one thing and another.**

There is a series of subordinations running throughout all nature. In the church there are several degrees of subordination, as of deacons to priests, priests to prelates, &c. The like are observable in the secular state, in offices of war, justice, &c. And, even in the sciences, trigonometry is subordinate to geometry: and in the virtues, abstinence and chastity are subordinate to temperance: in music, some call the plagal tones subordi-

**NATION.**

**SUBORNATION, See Rape and Ravishment.**

**SUBORNATION, Subornation, a secret or under-hand preparing, influencing, or bringing in a false witness; or corrupting or alluring a person to do such a false act. Hence, the subornation of perjury, mentioned in the act of general pardon, 12 Car. II. c. 8. is the alluring or disposing to perjury.**

**SUBPERPENDICULAR.** See **Subnormal**.

**SUBPENA, in Law, a writ, by which any person, under the degree of peerage, is called to appear in chancery, in cases where the common law hath made no provision. See **Suit**.**

The name is taken from the words in the writ, which charge the party summoned to appear at the day and place assigned, ab puncto centum librarum, on the penalty of a hundred pounds.

The peers, in the like cases, are called by the lord chancellor's letter, giving notice of the suit intended against them, and requiring them to appear.

The writ of subprena, returnable into the court of chancery only, was devised by John Waltham, bishop of Salisbury, and chancellor to king Richard II., by a strained interpretation of the oath. Wefin, 2. in order to make the oath to use accountable to his confitique yuse, which process was afterwards extended to other matters wholly determinable at the common law, upon false and fictitious fugitives; for which, therefore, the chancellor himself is, by
7 Ric. II. c. 6. directed to give damages to the parties unjustly aggrieved. In the reigns of Henry IV. and V. the commons were repeatedly urgent to have the writ of subpoena entirely superseded as a novelty devised by the subtlety of chancellor Waltham, against the form of the common law; but though Henry IV. gave a palliating answer to their petitions, and actually passed the statute 4 Hen. IV. c. 25, by which judgments at law are declared irrevocable, unless by attainder or writ of error, yet his son put a negative at once upon their whole proceeding and, in Edward IV.'s time, the process by bill and subpoena was become the daily practice of the court. Bl. Com. book iii.

There is also a subpoena ad testificandum, for summoning of witnesses in other courts, as well as in chancery. See Evidence.

The subpoena dux tecum, is a writ of process of the same kind with the preceding, including a cause of bringing and produce books and papers, &c. in his hands, belonging to the parties, or such in which they are interested.

There is also a subpoena in the exchequer, as well in the court of equity there, as in the office of pleas.

SUBPRINCIPALIS, in some Latin writers of Music, is used for the note or chord called by the Greeks πεπρωμοσ, par-bopaste.

SUBPURGATION, Subpurgatio, a word used by some writers to express a gentle purgation.

SUBREGUA, in Geography, a town of Naples, in Abruzzo Ultra; 18 miles E. of Aquila.

SUBREPTIO, Subreptio, formed from sub, under, and repto, l creep, the act of obtaining a favour from a superior by surprize, or a false representation.

Subreption differs from subversion, in that the latter denotes a false expression of the quality of a thing, or fact, &c. And subreption, a want of expression, or a fraudulent reticency or concealment of a thing, which would have rendered the obtaining of the favour more difficult. See Sub垸ition.

SUBREPTITIOUS, or Subreptitious, a term applied to a letter, licence, patent, or other act, fraudulently obtained of a superior, by concealing some truth, which, had it been known, would have prevented the concession or grant.

The benefit of letters, licences, &c. is forfeited, when they are found contrary to the information given; they being then reputed subreptitious.

Papal bulls and signatures are null and subreptitious, when the true state of the benefice, the manner of the vacancy, and other necessary matters, are not justly and properly signified to the pope.

SUBROGATION, or Subrogation, in the Civil Law, the act of substituting a person in the place, and entitling him to the rights of another.

In its general sense, subrogation implies a succession of any kind, whether of a person to a person, or of a person to a thing.

There are two kinds of subrogation; the one conventional, the other legal.

Subrogation, Conventional, is a contract by which a creditor transfers his debt, with all its appurtenances, to the profit of a third person.

Subrogation, Legal, is that which the law makes in favour of a person, who discharges an antecedent creditor; in which case, there is a legal transtion of all rights of the ancient creditor to the person of the new one.

This the civilians more usually call subrogation, as being wholly the work of the law; and to distinguish it from the conventional subrogation, which they also call subrogation.

The verb is formed from the Latin, subrogatio, of the verb regare, which, among the ancient Romans, signified to ask, to interrogate; whence it was that they called the laws themselves regationes, in regard the people made them, upon being asked by the magistrates.

And, as laws made by the people could not be changed without their consent, and without being asked anew; if they thought good to have the law wholly abolished, lex abrogabatur; if only a part of it were to be abolished, lex derogabatur; and if any clause or amendment were added to it, lex subrogabatur.

The new magistrates were also subrogated in the place of the old ones; for, during the time of the republic, no magistrate could be, but by consent of the people, nor of consequence but by law, since whatever the people thought good was law.

This is what occasioned Salamanus to say, that subrogans and sublitura per legem, were reciprocals.

SUBSAGUR, in Geography, a town of Hindoostan, in Vissapour; 16 miles S. of Huttany.

SUBSCAPULAR, in Anatomy, the large branch of the axillary artery, which arises near the lower margin of the scapula. See Artery.

SUBSCRIPTION, the signature put at the bottom of a letter, writing, or instrument.

In church history we meet with instances of subscriptions in the life of Ignatius, written with the blood of Jesus. Nicetus, speaking of the subscriptions made at the council, in which that patriarch was deposed, says, they subscribed, not with common ink, but, what strikes a man with horror, with a pen dipped in the blood of Christ. The historian Theophanes tells us, that pope Theodore mixed the blood of Christ with ink; in which he wrote the deposition of Pyrrhus.

Subscription, in the English Commerce, is used for the share or interest which particular persons take in a public stock, or a trading company, by writing their names, and the shares they require, in the books or registers of it.

The French have likewise adopted the word subscription, using it in speaking of the actions of their India company.

A subscription differs from an action, in that the first is properly only an action begun, or an engagement, by making the first payment to acquit the rest in the time limited; and that the other is the whole action, performed in all its parts.

Subscription, in the Commerce of Books, signifies an engagement to take a certain number of copies of a book going to be printed; and a reciprocal obligation of the bookeller or publisher to deliver the said copies on certain terms. The usual conditions of these subscriptions are, on the part of the bookeller, to afford the books cheaper to a subscriber than to another, by one-third or one-fourth of the price; and on the part of the latter, to advance half the money in hand, and to pay the rest on the delivery of the copies; an agreement equally advantageous to the one and the other, as the bookeller is, by this means, furnish'd with money to carry on works, which would otherwise be above his stock; and the subscriber receives, as it were, interest for his money, by the moderate price the book stands him in.

Subscriptions had their rise in England, and it is but very lately that they have got into other countries. They were first
SUBSCRIPTION.

first set on foot in the middle of the last century, for the printing of Walton's Polyglot Bibles, which was the first book ever printed by way of subscription.

From England they passed a few years ago into Holland, and they have been since introduced into France.

In England they are become exceedingly frequent; and their frequency has rendered them liable to some abuses, which begin to discredit them.

Subscription to Articles of Faith (see Articles) is a written, solemn declaration of the subscriber's assent, and is governed, according to the statute of archdeacon Paley, by the same rule of interpretation with oaths—which rule is the "animus imponentis." The inquiry, therefore, concerning subscription will be, "qux impuluit, et quo animo." The bishop who receives the subscription, says this ingenious writer, is not the imposer, any more than the cryer of a court, who administers the oath to the jury and witnesses, is the person that imposes it; nor consequently is the private opinion or interpretation of the bishop of any significance to the subscriber, one way or other. The compilers of the 39 articles are not to be considered as the imposers of subscription, any more than the framers or drawers up of a law is the person that enacts it. The legislature of the 13th Eliz. is the imposer, whose intention the subscriber is bound to satisfy. They who contain, that nothing less can justify subscription to the 39 articles, than the actual belief of each and every separate proposition contained in them, must suppose, that the legislature expected the content of 10,000 men, in perpetual successio, not to one controverted proposition, but to many hundreds. It is difficult to conceive how this could be expected by any, who observed the incurable diversity of human opinion upon all subjects short of demonstration or oaths—which rule law did not intend this, what did they intend? Our author replies to this question, that they intended to exclude from offices in the church, 1. All abettors of Popery; 2. Anabaptists, who were at that time a powerful party on the continent; and 3. The Puritans, who were hostile to an episcopal constitution; and in general the members of such leading sects or foreign establishments, as threatened to overthrow our own. Whoever, he says, finds himself comprehended within these descriptions, ought not to subscribe. For the general reasons upon which he justifies the imposition of this test on the teachers of religion, we refer to the article Religion; where it will appear, that this excellent writer seems to intimate, that our articles of faith might be converted into articles of peace, and acknowledges, that subscriptions perpetuate the procreation of sects and tenets, from which any danger has long ceased to be apprehended. The cales in which subscription to the 39 articles is required are, those of clergy officiating in the church, and entitled to its preferments and emoluments, and of schoolmasters, of young men in the university of Oxford or Cambridge at the time of their matriculation; and at Cambridge all degrees in arts, law, phyic, music, and divinity, are guarded by subscription, nor are any admitted to their first degree of bachelor of arts without a bonâ fide subscription, i.e. "I, A.B., do declare that I am bonâ fide a member of the church of England as by law established." We must here, however, observe, that the three articles contained in the 36th canon, are those that are subcribed at Cambridge for a bachelor of divinity's degree, and for a doctor's in any faculty, divinity, law, or phyic. They include all the 39 articles, and are as follow:

1. That the king's majesty, under God, is the only supreme governor of the realm, and all other his highness's dominions and countries, as well in spiritual or ecclesiastical
SUBSCRIPTION.

Epioton." In queen Elizabeth's reign, 13 articles were let out by order of the metropolitans, and the rest of the bishops, "for the unity of doctrine, to be holden by all parsons, vicars, and curates, as well in tesionification of their common consent in the said doctrine, as to the stopping of the mouths of those, who go about to slander the ministers of the church for diversify of judgment." Some time after all of them were surveyed, and at length compiled within a system of 39 articles. These articles were again ratified by James I., according to the form commonly prefixed to the book of articles of queen Elizabeth; in which, among other things, are these words, "that the articles of the church of England (which have been allowed and authorized heretofore, and which our clergy have generally subscribed unto) do contain the true doctrine of the church of England, agreeable to God's word; which we do therefore ratify and confirm, requiring all our loving subjects to continue in the uniform profession thereof, and prohibiting the least difference from the said articles, &c." It is added, after an assertion "that we be supreme governor of the church of England," and the recital of some other particular obervations relating to these articles, "that no man hereafter shall either print or preach to draw the article and shall submit to it in the plain and full meaning thereof, and shall not put his own sense or comment to be the meaning of the articles, but shall take it in the literal and grammatical sense:"

"That if any public reader in either of our universities, or any head or master of a college, or any other person respectively in either of them, shall affix any sense to any article, or shall publicly read, determine, or hold any public disputation, or suffer any such to be held either way, in either the universities or colleges respectively; or if any divine in the land (who shall present or print any thing either way, other than is already established in convention with our royal assent; he or they the offenders shall be liable to our displeasure, and the churches cenpurchase in our commission ecclesiastical, as well as any other; and we will see there shall be due execution upon them."

By 13 Eliz. c. 12. none shall be admitted to the order of deacon, unless he shall first subscribe to the said articles.

And by the statute of 1786, no person shall be received into the ministry, nor by either by institution or collation admitted to any ecclesiastical living, nor suffered to preach, catechize, or to be a lecturer or reader of divinity in either university, or in any cathedral or collegiate church, chantry, or market-town, parish-church, chapel, or in any other place, except he shall first subscribe to this article following: viz. "That he alloweth the book of articles of religion agreed upon by the archbishops and bishops of both provinces, and the whole clergy in the convention holden at London, in the year of our Lord God one thousand five hundred fifty and two; and that he acknowledgeth all and every the articles therein contained, being in number nine and thirty, besides the ratification, to be agreeable to the word of God."

And by the statute of 13 Eliz. c. 12. no person shall be admitted to any benefice with cure, except he shall first have subscribed the said articles in the presence of the ordinary; and all admissions to benefits of any person contrary to this act, and all dispensations, qualifications, and licences to the contrary, shall be merely void in law, as if they never were.

The 13 & 14 Car. II. c. 4. require subscription to the 39 articles mentioned in the 13th Eliz. c. 12. and a declaration of unfeigned affent and consent unto, and approbation of them, under certain express penalties. It has been observed, however, that by the 13 Eliz. c. 12. subscription is enjoined to those articles which only concern the profession of the true Christian faith, and the doctrine of the sacraments; and that by 14 Car. II. the articles to be subscribed, are the articles mentioned in the preceding statute: the limiting clause, therefore, being still in force, there is no act of the legislature, imposing subscription to all the 39. Such is the opinion of Archdeacon Blackburne and Mr. Selden, but others are of a different opinion. We shall here merely remark, that the origin of the Act of Uniformity under Charles II. and various clausules in the act itself, suppose the reception of the disciplinarian, as well as the doctrinal and sacramental articles, and that the canons of the church do actually impose them all.

Can it be said, as some persons have argued, that a latitude of interpretation may be applied to articles which were framed to testify common consent, and which were designed to prevent a diversity of judgment? By those who are acquainted with the history of the times under consideration, and with the sentiments and character of the compilers and impensors of the articles, it must, as it has been conceived, be allowed, that the notion of diversity of judgment never entered into the minds of the English reformers: they supposed that the Scriptures had but one meaning, and with an excess of confidence imagined, that they were in possession of the truth. In confirmation of this it has been urged, that when the "Harmony of Confessions" was published, among those of other reformed churches, that of the church of England appeared. So that bishop Burnet, though disposed on other occasions to a liberality of interpretation, and though he left his dying testimony against the hard injunction of subscription, (Conclusion of his History, vol. ii. p. 634, fol. ed.) ingeniously confesses in his "History of the Reformation," (vol. ii. p. 169,) that the 39 articles were something more than articles of peace, and adds, "that the men who subscribed them, when they were first sent out, did either believe them to be true, or else they did greatly prevaricate." The bishop’s opinion seems to have remained unaltered; for when his Exposition was about to be published, bishop Williams strongly recommended that they might be considered only as articles of peace. Upon which the late judge Burnet, mentioning this incident in his father’s life, observes "that there might, perhaps, be reason to wish that they had been only imposed as such; but there was nothing in our constitution to warrant a supporter in giving that sense to them." Those who respect the opinion of these two able judges, the one of the original intention of the church, the other of the point of law, cannot confidently contend for the pacific sense of subscription. According to the intent of the first subscriptions, maintained by the bishop in his Hift. Reform. above-cited, he could no more give the subscribers of the present age the privilege of availing themselves of different grammatical terms, than he could allow them to consider the articles as articles of peace. Did not the royal declaration prefixed to them, to which we have already referred, and never invalidated by any act of the legislature, preclude a latitude of subscription? The articles
The subscription of young persons, at the age of 16, on occasion of their matriculation at one of our universities, and at the other on taking various degrees, has been lamented by many thoughtful and candid persons, both in and out of the established church: and whilst disputes about the sense and extent of subscription have remained undecided, and persons of literature and liberality enter the church, or continue in it, under this condition, it has been concluded by uninterested observers of their conduct, that subscription cannot afford any great security to any church of the foundresses of its ministers. While there is such a diversity of opinions concerning the very act which is required in order to prevent it, it is no wonder that many reflecting persons with to decline it, and more especially to see lay-subscription altogether abolished. Whatever may be our own private opinion on this subject, we feel the force of the objections that have been urged against it by enlightened and upright members of the church establishment; nor can we forbear expressing a wish, without the prospect or possibility of deriving any advantage from the event, that some other mode of theological or political orthodoxy could be devised, and that the church and the legislature would think themselves safe in adopting it. The honours and emoluments suspended upon this act, and either directly or remotely accruing from it, both in the church and state, present temptations which embarrass youthful integrity, and which in some instances have perplexed and dissuaded persons of mature years. Perhaps more relaxed terms of conformity would not be injurious either to the established church, against which liberal dissenters and Catholics have no hostility, or to lay-professions, for the exercise of which in various situations, and with peculiar honour and advantage, subscription is a preliminary condition.

Experience seems to have proved, that subscription to articles of faith and creeds of human compilation, may be relaxed and even abolished with great satisfaction to the parties immediately concerned, and without entailing any injury on the civil or ecclesiastical community.

When Protestant-different ministers, in the years 1772 and 1773, applied to the legislature for relief in the matter of subscription, they twice met with a repulse: at length, however, in 1779, relief was granted; and though it was not granted in the extent which was desired, what was the consequence? The consequence was, that so far from having been productive of any evil, it almost past unnoticed: the whole result was, that those dissenting ministers who could comply with the requisition demanded, were placed in a state of legal security, without the least hazard to the church. Some, indeed, have objected to any kind of subscription, even to the scriptures, as a condition of exercising the ministerial office: conceiving that it is not the province of the civil magistrate to interdict, or allow the exercise of a religious function. Every man, it has been said, who is thought capable of preaching, and whose real or imagined talents will induce any to hear him, has a right to employ his time and faculties in this way, provided that he be answerable with no overt act, that renders him legally amenable to the cognizance of the magistrate. See Toleration.

Subscriptions of Witnesses in Law. A will of lands must, by Stat. 29 Car. II. cap. 3, s. 5, be attested or subscribed by three credible witnesses at least; but for other conveyances, the actual subscription of the witnesses is not required by law, though it is prudent in them to do so, in order to affix their memory when living, and to supply their evidence when dead.

Subsequent, something that comes after another, particularly with regard to the order of time. See Posterior.
subsidized estates, after the nominal rate of 4s. in the pound for land, and 2s. for their goods; and for those of aliens in a double proportion. But this affront was made according to an ancient valuation, which was so low, that one subsidy of this fort did not amount to more than 70,000l.

It was anciently the rule never to grant more than one subsidy and two fifteenths, at a time; but this rule was broken through, for the first time, on occasion of the Spanish invasion in 1588, when the parliament gave queen Elizabeth two subsidies and four fifteenths. Afterwards, as money sunk in value, more subsidies were given; and we have an instance, in the first parliament of 1640, of the king's defining twelve subsidies of the commons, to be levied in three years.

The grant of scutages, tallages, and subsidies, by the commons, did not extend to spiritual preferments, those being usually taxed by the clergy themselves in convocation; which grants of the clergy were confirmed in parliament; otherwise they were illegal and not binding. A subsidy granted by the clergy was after the rate of 4s. in the pound, according to the valuation of their livings in the king's books, and amounted to about 20,000l.

Whilth this custom continued, convictions used to 8t as frequently as parliaments, but the last subsidies thus given by the clergy were those confirmed by flat. 15 Car. II. cap. 10. since which another mode of taxation has generally prevailed, which comprehends the clergy as well as the laity; in recompence for which the beneficed clergy have from that period been allowed to vote at the election of knights of the shire; and thenceforward also the practice of giving ecclesiastical subsidies has fallen into total disuse. The last instance of this kind of grant occurs in 1670. Blackett. Comm. book i. See Land-Tax.

In France the king alone, by his own authority, was accustomed to impose subsidies on his people, at his own discretion.

The term subsidy is applied to the pecuniary succour granted by a power that does not take part in a war, to another that is actually engaged in it. The term is also often used to signify a sum of money, paid annually from one sovereign to another, in return for a body of troops, furnished for his wars or kept ready for his service. The treaties for procuring such a resource are called "subsidy treaties." What Grotius says, that they who pay subsidies to other sovereigns, to engage them in their defence against powerful enemies, by fo doing acknowledge their own weaknesses, and that such an acknowledgment diminishes somewhat of their dignity; must be understood of such rates as are too weak to defend themselves, and who, in respect hereof, render themselves, in some measure, tributary; not of such as, subsisting by their own strength, give subsidies to their weaker neighbours, to prevent their being over-run by others.

Such, e.g. as the kings of England and France are, with regard to Sweden, and several other princes; to whom they generally grant subsidies in the treaties they conclude with them.

In the lift of English duties, or impositions, are divers kinds of subsidies: as the subsidyeward, or old subsidy, which is a duty composed of a tonnage and poundage duty; names arising from the different regulations by which it is imposed and levied: the new subsidy, which is to be raised, levied, and collected by the same rules and orders, and under the same penalties and forfeitures, as are signified in the several acts contained in the book of rates: the one-third subsidy, or the amount of one-third of the preceding subsidy; or of the net new subsidy of tonnage and poundage: the two-thirds subsidy, which is an additional subsidy of two third parts of the new subsidy, upon all goods liable to the said new subsidy, excepted in certain cases, excepted by acts of parliament, and contained in the book of rates: the subsidy of 1747, which over and above all subsidies, additional duties, impositions, &c. is a poundage duty of 1sd. in the pound, to be paid in ready money on goods and merchandize imported, except for tobacco, with respect to which it may be secured by bond; which duty is to be levied and collected by the same means, and under the same penalties, &c. as are directed for the old subsidy: subsidies on spirits: subsidy outwards, composed of a tonnage and poundage, and paid in ready money before shipping off, in order to exportation: subsidy granted in 1758-9, of poundage upon certain goods and merchandizes to be imported into this kingdom, &c. See Pothlertay's Díct. art. Subsidy. See Customs.

Subsistence, in the Military Art, is the money paid to the soldiers weekly, not amounting to their full pay, because their clothes, accoutrements, tents, bread, &c. are to be paid; it is likewise the money paid the officers upon account, till their accounts be made up, which is generally once a year, and then they are paid their arrears.

Subsistence, more generally, denotes either that species of subsistence which is found in the adjacent country, such as forage and corn; or that which is provided at a distance, and regularly supplied by a well-conducted commissariat, confiding chiefly of meat, bread, beer, &c. to which may be added wood or coals, and straw, which are always wanted in an army.

Substance, Subsanta, something that we conceive to subsist of itself, fabe, independently of any created being, or any particular mode or accident.

Thus a piece of wax is a subsistence; because we can conceive it as subsisting of itself, and of its own nature, without any dependence on any other created nature, or without any particular mode, form, colour, &c. See Mode.

It is a being, however, which is the subject of modes or accidents. Of substances, some are thinking or conscious beings, and others are extended and fold, or impenetrable. Of the former class is the human soul, and of the latter, philosophers consider matter only. If we exclude space out of our consideration, there will remain but these two sorts of substances, vis., matter and mind, or body and spirit; at least we have no ideas of any other subsistence but these. See Watts's Logic, chap. ii. sect. 2. and Phil. Eff. eff. ii.

Spinosa maintains, that there is but one subsistence in nature, of which all created things are so many different modifications; and thus he makes the soul of the same subsistence with the body. The whole universe, according to him, is but one subsistence; which subsistence he holds endowed with an infinity of attributes, in the number of which are thinking and extension. All bodies are modifications of this subsistence, considered as extended; and all spirits modifications of the same subsistence, considered as thinking. See Spinozism. See also Matter and Soul.

Mr. Locke's philosophy of substances is more just: our ideas of substances, that great author observes, are only such a combination of simple ideas as is taken to represent distinct things subsisting by themselves; and with the confused idea of substance is always the chief. Thus, the combination of the ideas of a certain figure, with the powers of motion, thought, and reasoning, joined to substance, make the ordinary idea of man: and thus the mind observing several simple ideas to coexist, together, which being preformed to belong to one thing, or to be united in one subject, are called by one name, which we are apt, afterwards, to talk of, and consider as one simple idea. See Idea.
We imagine these simple ideas do not subsist by themselves; but suppose some substratum, in which they subsist, which we call substance.

The idea of true substance is nothing but the supposed, yet unknown, support of those qualities which are capable of producing simple ideas in us.

The ideas of particular substances are composed out of this obscure and general idea of substance, together with such combinations of simple ideas as are observed to exist together, and are supposed to flow from the internal constitution and unknown essence of that substance.

Thus we come by the ideas of man, horse, gold, &c. Thus the sensible qualities of iron, or a diamond, make the complex idea of those substances, which a smith or a jeweller, commonly knows better than a philosopher.

The same happens concerning the operations of the mind, thinking, reasoning, &c. which we concluding not to subsist by themselves, nor apprehending how they can belong to body, or be produced by it, think them the actions of some other substance, which we call spirit; of whose substance or nature we have as clear a notion as that of body; the one being the supposed substratum of the simple ideas we have from without, as the other of those operations which we perform in ourselves, so altered in substance, so altered in our ideas, that the idea of corporeal substance in matter is as remote from our conceptions as that of spiritual substance.

Hence we may conclude, that he has the most perfect idea of any particular substance, who has collected most of those simple ideas which exist in it; among which we are to reckon its active powers, and passive capacities, though not strictly simple ideas.

Substances are generally distinguished by secondary qualities; for our senses fail us in the discovery of primary ones, as the bulk, figure, texture, &c. of the minute parts of bodies; the real essences and constitutions and differences depend, and secondary qualities are nothing but powers with relation to our senses.

The ideas that make our complex ones of corporeal substances, are of three sorts: 1. the ideas of primary qualities of things which are discovered by our senses; such as bulk, figure, motion, &c. 2. The sensible secondary qualities, which are nothing but powers to produce several ideas in us by our senses. 3. The abstracts we consider in any substance, to cause or receive such alterations in its primary qualities as are the influence of the senses and the mind should produce in us different ideas from what it did before.

Besides the complex ideas we have of material substances, by the simple ideas taken from the operations of our own minds, which we experience in ourselves, as thinking, understanding, willing, knowing, &c. co-existing in the same substance, we are able to frame the complex idea of a spirit; and this idea of an immaterial substance is as clear as that we have of a material one.

By joining the last with substance, of which we have no distinct idea, we have the idea of spirit; and by putting together the idea of coherent solid parts, and a power of being moved, joined with substance, of which, likewise, we have no positive idea, we have the idea of matter.

Farther, there are other ideas of substances, that may be called collective, which are made up of any particular substances, considered as united into one idea, as a troop, army, &c. which the mind does by its power of composition. These collective ideas are but the artificial draughts of the mind, bringing things remote and independent into one view, the better to contemplate the discourse of them united into one conception, and signified by one name. For there are no things to remote which the mind cannot, by this art of composition, bring into one idea, as is visible in that signified by the name universe.

Such is the generally received doctrine of substance; but Bishop Berkeley, in his Principles of Human Knowledge, and Mr. Collier, in his Clavis Universalis, have made great refinements on the subject.

Substances, Compound Earthy, for Plants, in Gardening, such compound earthy materials as are prepared and made use of in raising and cultivating particular sorts of plants of the finer flowers and other kinds. These confit of various kinds of sandy, peaty, dungy, animal, and other matters, mixed and put together in many different ways and proportions, according to the particular nature of the several plants and flowers to be grown in or upon them.

The earthy substances which are the most proper for these mixtures in many cases, and especially for the auricular plant kind, are, that which has been thrown up by the mole in dry, fine pasture-ground; that of fine maiden down-land, which is free from all sorts of stony matters; that of the surface spit of earth taken from strong yellow or hazel loams; and that of any good black, rather stiff, maiden mould land.

With two parts of the strong loam, or any other of these earthy matters, three of goose-dung soaked in bullock's blood, and of sugar-baked flour, may be mixed; in two parts of each of these two last matters, and the same proportion of night-foil; and two parts of the two former to four of the loam, soaked in night-foil and urine, with a small proportion of sea-fand. Also four parts of night-foil to two of cow-dung and loam, with a small proportion of sea-fand; and other still smaller proportions of these different substances, mixed and well blended together, may be made use of for this purpose. Several other mixtures of sandy, peaty, or bog-earthly, and other matters, are likewise necessary, in other cases, for raising and growing different plants and flowers. These different substances should be well mixed and incorporated together for a considerable length of time, after being first put together in that very early spring season, and being very often turned over during that time; as by such means they will become not only more intimately blended and united, but rendered more sweet and in better condition, as well as have the seeds of weeds, grubs, and insects, more perfectly destroyed. It will likewise be of great benefit to have these earthy substances exposed so as that they may have the influence of the sun and air; and it will be advantageous, too, to have them occasionally thrown out to the thickness of two or three feet, in order that they may be more fully acted upon by the powers of the sun during the summer, and be more equally affected by the frosts of the winter; and thereby be brought into a more fine, sweet, mellow state for the support of potted flower and other plants.

Plants are not so subject to rot and canker, it is said, where such substances have been turned over and exposed frequently, as every six weeks or two months, in preparing them, when they are employed in growing them; besides, they are raised much faster by them after they have been so managed.

In cases where insects, worms, or grubs prevail in substances of this nature, a little quicklime may be used, which not only tends to destroy them, but hardens the putrefaction and preparation of the materials for use, and which may be still more expedited by spreading them out.

Any of the above substances of this sort that contain sea-fand, will answer well for some other plants besides those of the auricular kind, as the more common sorts of polyanthus and primroses; but the finer kinds of these
SUB

It is supposed, the too rapid decomposition of the animal matter, and renders it very durable in its effects upon land.

Substances of the hair, woolen-rag, and feather kind, are all analogous, it is said, in composition, and that they principally consist of a substance similar to albumen, united to gelatine. This is shown to be the case, it is said, by the ingenious researches of the above-named inquirer; and that the theory of their operation is similar to that of bone and horn shavings.

Such manures as are formed from thee, as well as other animal substances, in general, require, it is thought, no chemical preparation to fit them for the soil or ground. The great object of the farmer should be to blend them with the earthy constituent matters in a proper state of division, and to prevent, as much as possible, their too rapid decomposition.

The use of bone-duft and horn-shavings has been found excellent on grass and mowing land. On a dairy farm, they have been employed for many years with very great success, in the quantity of from fifty to a hundred bushels an acre; which will constantly be sufficient, where the land is in any tolerable state, and will last for five or six years in great perfections. The advantage in carriage is very great, especially where the land lies at a distance, or through bad roads; as, at one load, sufficient may be drawn to manure an acre of ground. This, with their great durability, must, it is thought, recommend them to all such farmers as have the means of procuring them. It is now even, at the town of Sheffield, in Yorkshire, it is said, become a trade to grind bones for the use of the farmer, as a manure. If, however, bones be mixed in a heap with lime, they will, it is affeeted, in a short time be reduced to powder. The most proper season for applying these substances is in February or March; but they may be used at any other time of the year, the advantage of a wet day or two being always taken, as by that means they more readily settle into the ground. Very great swathes of hay and clover have been had, in some cases, by this means.

The writer of the Agricultural Report of Cornwall states, that a strip of land of fifteen yards width in that diocess, which had bone manure applied to it ten years ago, still shows the effect of it; and that so sweet is the herbage on it, that the cattle hang upon it as long as they can find a blade of grass. In this case, the quantity of boney matter laid on was about twenty-four Winchester bushels; and which had been previously covered with quick-lime, that the bones might be more easily broken; and, as soon as the lime became effete, they were picked out, which, though retaining their form, were readily reduced to powder by a hammer; and then, in this state, spread out thinly by the hand over the land.

Substances of the bony kind should, of course, be converted, as much as possible, to this use, in every situation where they can be had.

SUBSTANCES, Refining, for Common Salt, in Rural Economy, the several different matters employed in preparing, purifying, and clearing the liquor, or brine, in the making of this sort of salt. A great many substances are made use of in this way, and for this purpose; but the principal of them, and the most material effects which they produce, are thefe, as stated by Dr. Holland, in the Corrected Account of the Agriculture and rural Pratrices of Cheshire. Though there has been nothing exact or correct in the application of these substances, the chief additions which have been made use of in this view, at different times, are acids, animal jelly and gluten, vegetable mucilage, new or stale ale, wheat flour, resin, butter, and alum.

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The first, it is said, has not been much used at any time in the above district; and it is extremely doubtful whether any good effects arise from their use; though the use of four whey, by the Dutch, was long supposed to produce a superiority in their fat; but which is believed to be solely owing to the gentle fires with which they carried on the evaporation, and not to the acid added to the brine. This addition is now never made at any works in the above county. The second fort of substances, or those of animal jelly and gluten, have been much used for clearing the brine, and promoting the separation of the earthy contents, and they seem to be very similar in point of action, when added to the brine, to those which they have on wine and fermented liquors. The substances of this kind which have been used are blood, whites of eggs, glue, and calves' or cows' feet. Blood has been long used as an addition to the brine, for the purpose of clarifying it, as is evident from Jackson's account of the making of salt; and it is still occasionally used at some works, and, when fresh, is found highly useful; but the difficulty of procuring it in the quantity wanted, and of keeping it without putrefaction, are objections to its use in general. Whites of eggs have been frequently added to the brine, for the same purpose as blood; and though they are not now much used, it is not supposed that they would not answer the purpose, but that the same objection is capable of being effected by means less expensive. Glue is frequently used for clearing the brine, and is found to answer the purpose perfectly well; and this is the only substance used at many works. Vegetable mucilage, as that of linseed, has been occasionally used for clearing the brine, and has been found to produce the same effect as animal jelly; but an inconvenience attends the use of it in the large way: it becomes putrid soon after it is put into the brine, and then loses its mucilaginous quality. It seems probable, too, that new ale or flate ale, which were long used as additions to the brine for clarifying it, could have effect only as they contained a certain proportion of vegetable mucilage; the acid contained being of little or no consequence. They are now never used. Wheat-flour and rein have each, it is said, been occasionally added to brine, where the manufacturer has wished to produce a fat of small grain. The mucilage extracted from the flour may have some effect, if separated from the oily parts of the flour, but it is probable that these additions act mechanically, and, by the interposition of their small particles between the minute crystals of salt, may prevent the cohesion of these, and thus prevent the grain from small. These additions are rarely made in the above district. Butter or some other oily substance is very generally used as an addition to brine, during the evaporating process, and after the clearing has been made, to assist the granulation of the salt, and to make the brine work more kindly; and though it has been thought to have no good effect, experience leaves little room for doubting that the addition of it enables the salt to crystallize more readily.

Salt-makers have long, it is said, been in the habit of adding alum to their brine, when they wished to procure a hard firm salt, of large grain; and though some may have objected to its use, it is thought that it does assist in promoting the crystallization of the salt in large grains; but in what manner its effects are produced is not ascertained, as not more than three or four pounds of alum are added to a quantity of brine capable of yielding as many tons of manure of soda. The action and operation of these substances may be seen more fully explained in the work alluded to above.

Substances destructive of insects infecting Fruit-Shrubs and Trees, in Gardening, such as are capable of destroying them, or of preventing their injurious ravages and effects on trees. Many different kinds of substances have been recommended for the purpose, at different times; but nothing perhaps has yet been found fully effective in this intention, in all cases. The substances and modes directed below have latterly been viewed as useful in this way, in different papers inserted in the Memoirs of the Caledonian Horticultural Society.

As a preventive against gooseberry caterpillars, which frequently infect and injure shrubs of that kind, Mr. Macmurray, a nurseryman, has found the substances mentioned below as very simple and efficacious. In the autumn season, he says, let a quantity of cow-urine be provided, and let a little be poured about the stem of each bush or shrub, just as much as merely suffices to moisten the ground about them. This simple expedient is said to have succeeded in an admirable manner, and that its preventive virtues have appeared to extend to two successive seasons or years. The bushes which were treated in this manner remained free from caterpillars, while those which were neglected, or intentionally passed by, in the same compartment, were wholly destroyed by the depredations of the insects.

Another mode of prevention is proposed, which, it is said, is equally simple and effectual; but the good effects of which only extend to the season immediately succeeding to that of the application.

This is, in situations near the sea, to collect as much drift or sea-weed from the beach, when occasion serves, as will be sufficient to cover the whole of the gooseberry compartment to the depth of four or five inches. It should be laid on in the autumn, and the whole covering remain untouched during the winter and early spring months; but as the fruiting season advances, be dug in. This method, it is said, has answered his most sanguine expectations; no caterpillars ever infecting the compartments which are treated in this manner.

Another method, which is said to have been found successful in the practice and experience of Mr. Elliott, in preventing or destroying caterpillars on the above fort of fruit-shrubs, is this: as the black currant and elder bushes, growing quite close to those of the gooseberry kind, were not attacked by this fort of vermin, it was conceived that an infusion of their leaves might be serviceable, especially when prepared with a little quick-time, in the manner directed below. Six pounds each of the two first forts of leaves are to be boiled in twelve gallons of soft water; then fourteen pounds of hot lime are to be put into twelve gallons of water, and, after being well incorporated with it, they are both to be mixed well together. With this mixture the infected gooseberry bushes or fruit-trees are to be well washed by the hand garden-engine; after which a little hot lime is to be taken and laid about the root of each bush or tree to wash, which completes the work.

Thus the caterpillars will be completely destroyed; it is said, without hurting the foliage of the bushes or trees in any way. A dull day is to be preferred for performing the work of washing, &c. As soon as all the foliage is dropped off from the bushes and trees, they are to be again washed over with the hand-engine, in order to clean them of all decayed leaves, and other matters; for which purpose any fort of water will answer. The surface of the earth, all about the roots of the bushes and trees, is then to be well flivered, and a little hot-lime again laid about them, to destroy the eggs or eggs of the insects.
This mode of management has never failed of success, it is said, in the course of six years' practice.

It is noticed, that the above quantity of prepared liquid will be sufficient for about two acres of ground in this sort of plantation, and cost but little in providing.

The use of about a gallon of a mixture of equal proportions of lime-water, chamber-ley, and soap-uds, with as much foot as will give it the colour and consistence of dung-hill drainings, to each bush in the rows, applied by means of the role of a watering-pot, immediately as the ground between them is dug over, and left as rough as possible, the whole being gone over in this way without treading or poaching the land, has also been found highly successful by others. The whole is then left in the above state until the winter frosts are fairly past, when the ground between the rows and bushes are levelled, and raked over in an even manner. By this means of practice, the bushes have been conflantly kept healthy, fruitful, and free from the annoyance of insects. The bushes are to be first pruned, and dunged where necessary.

A solution of soft soap, mixed with an infusion of tobow, has likewise been applied with great use in destroying caterpillars, by squirting it by the hand-syringe upon the bushes, while a little warm, twice in the day. But some think that the only safety is in picking them off the bushes, as they first appear, together with the lower leaves which are eaten into holes: also, the paring, digging over, and clearing the soil ground between the bushes, and treading and forcing such soil surface parts into the bottoms of the trenches.

Watering cherry trees with water prepared from quicklime, burrs, and common fods used in washing, in the proportion of a peck of the former and half a pound of the latter to a hogshead of water, has been found successful in destroying the green-fly and the black vermin which infect such trees.

The water should stand upon the land for twenty-four hours, and then drawn off by a cock placed in the caff, ten or twelve inches from the bottom, when the fods is to be put to it, being careful not to exceed the above proportion, as, from its acidity, it would otherwise be liable to destroy the foliage. Two or three times watering with this liquid, by means of a garden engine, will, it is said, destroy and remove the vermin.

The application of clay-paint, too, has been found of great utility in destroying the different insects, such as the coccus, thrips, and fly, which infect peach, nectarine, and other fine fruit-trees, on walls, and in hot-houses. This paint is prepared by taking a quantity of the most tenacious brown clay, and diffusing it in as much soft water as will bring it to the consistence of a thick cream or paint, passing it through a fine sieve or hair-sieve, so as that it may be rendered perfectly smooth, unadualous, and free from gritty particles.

As soon as the trees are pruned and nailed in, they are all to be carefully gone over with a painter's brush dipped in the above paint, especially the stems and large branches, as well as the young shoots, which leaves a coat or layer, that, when it becomes dry, forms a hard crust over the whole tree, which, by closely enveloping the insects, completely destroys them, without doing any injury to either the bark or buds. And by covering the trees with matto or canvas in wet seasons, it may be preferred on them as long as necessary. Where one drenching is not effectual, it may be repeated; and the second coating will mostly be sufficient. Where peach and nectarine trees are managed with this paint, they are, it is said, very rarely either hide-bound or attacked by insects.

This sort of paint is also useful in removing the mildew, with which these kinds of trees are often affected; as well as, with the use of the dew-syringe, in promoting the equal breaking of the eyes of vines, trained on the rafters of pine trees. See Syringe, Dew.

Watering the peach-tree borders with the urine of cattle, in the beginning of winter, and again in the early spring, has likewise been thought beneficial in destroying the insects which produce the above disease. Careful and proper cleaning and washing these trees, walls, and other places in contact with them, has, too, been found of great utility in preventing insects from accumulating on them.

SUBSTANCE, Colourings, for Chees, in Rural Economy, the material used in colouring cheese in some districts. It mostly consists of a portion of annatto, which is used by rubbing it upon a stone kept for the purpose, and then mixing it in the liquid flate with the milk. It is regulated in quantity by the shade of colour which is to be given, without any fixed rule. The quantity of an ounce is mostly the allowance for a hundred weight of cheese. Substances of this kind are most commonly used for the thinner sorts of cheese.

SUBSTANTIAL, in the Schools, something belonging to the nature of substance.

SUBSTANTIVE is also used in the same sense with essential, in opposition to accidental; in which relation it gives room for abundance of distinctions.

SUBSTANTIVE, in Grammar, is a quality ascribed to a noun or name, when the object it denotes is considered finally, and in itself, without reference to any other subject or idea. See Nouns.

Substantives, according to Mr. Harris, are all those principal words which are significant of substances, considered as substantives. See Speech.

Some of these are primary, or substantives properly so called, and have number and gender, and denominated nouns; and others are secondary, which are otherwise called pre-nouns. Hermes, ch. iv. and v.

Nouns substantive sometimes are used adjectively; and nouns adjectival also sometimes become substantives. See Nouns.

Indeed, custom does not allow us to use all adjectives indiscriminately, as substantives; nor all substantives as adjectives.

The laws observed in this respect are as follow:

All nouns either signify an individual, as Socrates, Alexander, &c.; or a species, as man, horse, &c.; or an essential quality, as rational, material, &c.; or an accidental one, as black, white, good, fair, &c.; or a dignity, office, art, &c.; as king, president, philosopher, &c.

Thus have we four kinds of nouns, of which the first is very rarely taken adjectively; for as they signify individuals, or particular beings, they can scarcely be applied to any thing but the thing they properly signify; yet we have sometimes known the name of Cato taken adjectively; as, This is to be Cato, indeed. Nor does Mallerbe scruple to say in French, Plus Marre que le Mars de la Thrace. Add, that proper names are sometimes converted into names of dignities, &c. as Caesar, Augustus, &c. In which case they may be considered, in the same light, as nouns of the fourth kind. Nouns of the second kind are also sometimes taken adjectively, as He is much a man, &c. The third kind are adjectives of themselves. For the fourth kind, all grammarians rank them among substantives, excepting F. Buxtorf, who will have them to be adjectives; or, to use his own
term, modificatives. Be that as it will, they are frequently used adjectively: *He is more a king, and more a philosopher, than any of his predecessors.*

Now, for adjectives taken substantively, 1. Participles passive are very rarely thus taken; though we sometimes say, *The loved are less happy than the lovers:* the taught have the advantage of the untaught: the befogged make a folly, &c. And, 2. Participles active are taken still more rarely for substantives. We scarcely ever, e.g., say, *the viewing, the reading; but* the lover, *the reader:* yet we say, *the fluent, the protestant, the tenant, the appellant, the opponent,* &c. 3. For nouns adjective, those applied to men are not only used substantively, but are even become substantives by use, whether they be such as regard religion, as Christian, pagan, Mahometan, &c.; or opinion, as Stoic, Peripatetic, Cynic, &c.; or country, as the English, French, Italian; or temperament, as the melancholy, phlegmatic, choleric, &c.

Under the same rule are likewise comprehended abundance of adjectives, signifying a number of people agreeing in some common attribute; as, *the learned, the great, the devout, the brave, the disinterested.* But use is here to be regarded; for we do not say the elegant, as we say the learned; but elegant writers, &c. Cullum, and the ear alone, are to decide these.

Again, adjectives taken substantively, for other things besides men, are either so used, to signify a number or sort of things that have some common quality; or to express an abstract quality. In both which, as in those men, there are some authorized by custom, and others formed every day on their model.

With regard to which last, use again, and the ear, are to decide. Here all the adjectives of colours are used substantively, as the white, black, green, &c. Some of those of qualities, as the cold, &c.; those of time, as the past, present, future; and many other matters, as the agreeable, the sublime, the principal, &c. Nor is it only in the positive, but also in the comparative and superlative degrees, that adjectives are used substantively; as the better of the two; the less of it, &c.

**SUBSTANTIVE VERB.** See **VERB.**

**SUBSTITUTE, SUBSTITUTE,** formed from sub, under, and statuo, *I appoint, or establish,* a person appointed to officiate for another, in case of absence, or other legal impediment.

A substitut in the militia is a person who voluntarily offers to serve in the room of another that has been chosen by ballot. But if he himself should be afterwards chosen by ballot, he is not exempted from serving again, as principals are, within certain restrictions. Substitutes may be provided for Quakers. Every substitute is liable to a penalty for not appearing to be sworn upon due notice being given; and every regularly enrolled soldier, who shall offer to serve as a substitute in the militia, is liable to forfeit $10; or to be imprisoned. Substitutes who defect are to serve the remainder of their time when taken.

**SUBSTITUTE, in Medicine, denotes a drug, or remedy, that may be used in lieu of another; or that supplies the place of another of like virtue, which is not to be had; called also succedaneum.**

**SUBSTITUTES, in Ship-Building.** For wood knees, that article of late being very scarce, many substiutes have been proposed and used. For instance, knees made of iron have been and are now much used in merchant-ships, particularly in East Indiamen. For hanging knees, and have been found to answer very well. But in king’s ships, wood and iron combined together, are used in more ways than one to connect the fids and beams together. One method was by an oak-chock at each end of the beam, sided as large as the beam at the upper end, and to taper to two-thirds of that size at the lower end, and moulded about two feet broad at the upper end, and one-third of that at the lower end, which reaches down six inches upon the spirit-kitting. Those chocks are fayed to the side, and close up to the under side of the beam, in such manner as to have a mortice, about one inch and a quarter by one inch and three-quarters deep, within and clear of the iron-plate knees. They are then bolted through the side with six bolts; the two upper bolts to be one inch and three-eighths; the two middle, one inch and a quarter; and the two lower ones, one inch and one-eighth. The beams are then secured to the chocks by iron-plate knees, five inches broad and one inch and an eighth thick: the arms along the beam and down the chock to be each four feet long, with a return or arm at the upper part against the side, about eighteen inches long each: the chock and beam-arm are connected by a diagonal brace, just to clear the front of the chock: before the plates are let in, iron keys are driven in the mortice at the head of the chock, which are sheathed with copper for that purpose. The iron-plate knees are then let in flush their thickness into the side of the beam and chock, one on the fore-side and one on the aft-side, the fluted and clotted through each other, with four bolts through the beam-arms, four through the chock-arms, and one through the middle of the brace of one inch and three-eighths, and two bolts through the side in each return or fore and aft arm, one of inch and three-eighths and one of inch and a quarter.

Observe, when any of the beams come over a port, they are to be knead at each end with one wood lodging and one wood or iron hanging knee, to cast clear of the side of the port.

At present, the fids are farther secured with a shelf, having a chock underneath, and an iron knee in front, under each beam. Thus the shelf is a piece of thick stuff of ten inches deep and about fourteen inches broad,ayed along the side and under-side of the beams all fore and aft, and scarfs one into the other, with a scarf fix six feet long, or in the round of the bow to have anchor-rock pieces fayed into the scarfs. The fore end of the shelf laps about four feet under the deck-hook, and douels thereto with two or more douls, and bolts upwards through the hook.

In the fids, the fids, the atf, and the clamps, with the arms, the arms, the facebook pieces to each side, and four douls in each scarf, and two douls upward into each beam and into the deck-transform; it is then set close, and bolted through the side with one inch and quarter bolts, about twenty inches and a half. The edges of the beams are next bolted through the shelf, with one bolt of an inch and a quarter, to clear the heads of the chocks, and one also through the water-ways.

Under each beam is fayed an oak-chock, close up under the shelf, ten inches sided, and moulded at the head to the breadth of the shelf, and at the heel not less than three inches, which reaches down to the spirit-kitting. In the front of each chock is fayed an iron knee, five inches broad and five inches thick at the shoulder, and one inch thick at the extremities, that is, the beam-arm to be three feet six inches long, and the arm on the chock to reach about six inches, or to take a bolt through the spirit-kitting; the beam-arm has four bolts, of one inch and three-eighths, driven upwards, and the chock-arm five bolts of one inch and three-eighths, except the two lower ones, which may be one-eighth less.

Sometimes these knees, instead of an arm along the beam, have a strap on each side, which claps the beam and bolts, with
with two bolts through the beam fore and aft, and one upwards at the shoulder or return.

Observe, that the foregoing given dimensions are for securing the gun-deck beams of a seventy-four gun ship, consequently the decks above are less in proportion, as likewise ships of a less rate.

SUBSTITUTION, in Grammar, the using of one word for another; or one mode, statue, person, or number, of a word for another. This the grammarians otherwise call a *fide commissa*.

SUBSTITUTION, in Civil Law, a disposition of a testator, by which he substitutes one heir to another, who has only the usufruit, and not the property of the thing left him.

Substitution is a kind of fiduciary inheritance, called also *fide commissa*, in regard the immediate inheritor has only the use or produce of the thing; the body of it being substituted and appropriated to certain persons, who are likewise to have the usufruit in their turns, but are never to have the property.

In some countries substitution is perpetual; in France it only holds to the fourth generation. Substitution answers to *remainder* in common law.

Among the Romans there was abundance of these fiduciary heirs, who enjoyed inheritances till they returned them into the hands of the right heir; and the reason why they did not likewise restore the fruits, or that the fruits were not deemed to make a part of the inheritance, but only of the thing, was, that the fiduciary or trustee was obliged to run the risk, and to hand the charge of the culture of the land.

SUBSTITUTION, in Algebra, &c. is the putting in the room of any quantity in an equation, some other quantity which is equal to it, but expressed by another manner. See *Reduction of Equations*.

SUBTRACTION, or Subtraction, in Arithmetic, the second rule, or rather operation, in arithmetic, by which we deduce a less number from a greater, to learn the precise difference.

Or, more jutly, subtraction is the finding of a certain number from two homogenous ones given, which with one of the given numbers, is equal to the other.

The doctrine of subtraction is reducible to what follows:

To Subtract a Less Number from a Greater. 1. Write the less number under the greater, in such manner, as that homogenous figures answer to homogenous, i.e. units to units, tens to tens, &c. as directed under Addition.

2. Under the two numbers draw a line. 3. Subtract, severally, the units from units, tens from tens, hundreds from hundreds; beginning at the right hand, and proceeding to the left: and write the several remainders in their correspondent places, under the line. 4. If a greater figure come to be subtracted from a less, borrow an unit from the next left-hand place; this is equivalent to 10, and, added to the less number, the subtraction is to be made from the sum; or if a cipher chance to be in the next left-hand place, borrow the unit from the next farther place.

By these rules any number may be subtracted out of another greater. For example:

If it be required, from 9800403459 To subtract 4743865263

The remainder will be found 505658196

For, beginning with the right-hand figure, and taking 3 from 9, there remain 6 units, to be written underneath the line: going then to the next place, 6, I find, cannot be taken from 5; wherefore, from the place of hundreds, 4. I borrow 1, which is equivalent to 10, in the place of tens; and from the sum of this 10 and 5, viz. 15, subtrahend 6, I find 9 tens remaining, to be put down under the line. Proceeding to the place of hundreds, 2, and the 1 borrowed at the left, make 3, which subtrahend from 4, leave 1.

Again, in the place of thousands, cannot be subtrahend from 3; for which reason, taking 1 from 4, in the place of hundreds of thousands, into the empty place of tens of thousands, the cipher is converted into 10 tens of thousands; whence one 10 being borrowed, and added to the 3, and from the sum 13 thousand, 5 thousand being subtrahend, we shall have 8 thousand to enter under the line; then subtrahend 6 tens of thousands from 9, there remain 3. Coming now to take 8 from 4; from the 8 farther on the left, I borrow 1, by means of which, the two ciphers will be turned each into 9. And after the like manner is the rest of the subtraction safely performed.

If heterogeneous numbers be to be subtracted from each other, the units borrowed are not to be equal to ten, but to so many as there go of units of the less kind, to constitute an unit of the greater: for example:

\[
\begin{array}{c|c|c|c}
 & \text{l.} & \text{r.} & \text{d.} \\
\hline
45 & 16 & 6 \\
27 & 19 & 9 \\
\hline
17 & 16 & 9
\end{array}
\]

For since 9 pence cannot be subtracted from 6 pence; of the 16 shillings, one is converted into 12 pence; by which means, for 6 we have 18 pence; whence 9 being subtrahend, there remain 9. In like manner, as 19 shillings cannot be subtracted from the remaining 16; one of the 45 pounds is converted into 20 shillings, from which, added to the 16, 19 being subtrahend, the remainder is 16 shillings. Lastly, 27 pounds subtracted from 44 pounds, there remains 17.

If a greater number be required to be subtracted from a less, it is evident the thing is impossible. The less number, therefore, in that case, is to be subtracted from the greater; and the defect to be noted by the negative character. E.g. If I am required to pay 2 pounds, and am only matter of 3, when the 3 are paid, there will remain 5 behind, which are to be noted, — 5.

Subtraction is to be proved by adding the remainder to the subtrahend, or number to be subtracted: for if the sum be equal to the number whence the other is to be subtracted, the subtraction is jutly performed. For example:

\[
\begin{array}{c|c|c|c|c|c}
& \text{l.} & \text{r.} & \text{d.} \\
\hline
9800403459 & 156 & 11 & 3 \\
4743865263 & 21 & 17 & 3 \\
\hline
505658196 & 134 & 14 & 0 \\
\hline
9800403459 & 156 & 11 & 3 \\
\end{array}
\]

Subtraction, in Algebra, is performed by connecting the quantities with all the signs of the subtrahend changed; and at the same time uniting such as may be united; as is done in addition; which fee.

Thus + 7 as subtracted from + 9 a, makes + 9 a — 7 a, or 2 a.

In the subtraction of compound algebraic quantities, the characters of the subtrahend are to be changed into the contrary ones, vis. + into —; and — into +.
As the addition of algebraic quantities includes three cases, viz. 1. The addition of like quantities with like signs, for which the rule is to add the co-efficients, to prefix the common sign to their sum, and to subjoin the common letter or letters: 2. The addition of quantities that are like with unlike signs, for which the rule is to substract the smaller co-efficient from the greater, to prefix the sign of the greater to the remainder, and to add to the common letter or letters: and 3. The addition of quantities that are unlike, for which they are made like by the signs or co-efficients prefixed: the general rule for substraction, comprehending all the cases that occur, is, change the signs of the quantity to be substracted into their contrary signs, and then add it to changed to the quantity from which it was to be substracted; the sum arising by this addition is the remainder, because, to substract any quantity, either positive or negative, is the same as to add the opposite kind.

From + 5 a
Substract + 3 a
Rem. 5 a - 3 a or 2 a.

From + 5 a
Substract - 3 a
Rem. + 5 a + 3 a = 8 a.

From - 5 a
Substract + 3 a
Rem. - 5 a - 3 a = - 8 a.

From - 5 a
Substract - 3 a
Rem. - 5 a + 3 a = - 2 a.

From 2 a - 3 x + 5 y - 6
Substract 6 a + 4 x + 5 y + 4
Rem. - 4 a - 7 x - 9 y - 10.

SUBTRACTION of Logarithms. See LOGARITHMS.
SUBTRACTION of Vulgar Fractions. See FRACTIONS.
SUBTRACTION of Decimals. See DECIMALS.

SUBTRACTION of Surds. See SUBTRACT.
SUBSTRENS, in Agriculture, a term sometimes used to signify the under stratum or bed of soils, or that which is interposed between the surface layer of materials, and the base or substructure upon which the whole is disposed or laid. See SOIL and STRATA.

SUBTRUCTION, in Building, denotes underpinning, ground-footing, &c. See Foundation.

SUBSTYLE, or SUBSTYLAN LINE, in Dialling, a right line, on which the style or gnomon of a dial is erected.

The angle included between this line and the style, is called the elevation or height of the style. See Style.

In polar, horizontal, meridional, and northern dials, the substyle line is the meridional line, or line of 12 o'clock; or intersection of a plane, on which the dial is delineated, with that of the meridian.

In all declining dials, the substyle makes an angle with the hour-line of XII, and this angle is called the distance of the substyle from the meridian.

In easterly and westerly dials, the substyle line is the line of 6 o'clock, or the intersection of the plane, on which the dial is delineated, with the prime vertical.

SUBSUPERPARTICULAR. See Ratio.

SUBSUPERPARTIENS. See SUBNORMAL.

SUBTANGENT of a Curve, the line that determines the intersection of a tangent with the axis; or that determines the point in which the tangent cuts the axis, prolonged.

Thus in the curve $AM$, &c. (Plate XIV. Analysis, fig. 5.), the line $TP$ intercepted between the semiordinate $PM$, and the tangent $TM$, is the subtangent. And $PR$ is to $PM$, as $PM$ to $PT$; and $PM$ to $PT$, as $MR$ to $TM$. See SUBNORMAL.

It is a rule in all equations, that if the value of the subtangent come out positive, the point of intersection of the tangent and axis falls on that side of the ordinate, where the vertex of the curve lies; as in the parabola and paraboloids. If it come out negative, the point of intersection will fall on the contrary side of the ordinate, in respect of the vertex or beginning of the absciss; as in the hyperbola and hyperboliform figures.

And universally, in all paraboliform and hyperboliform figures, the subtangent is equal to the exponent of the power of the ordinate, multiplied into the absciss: thus, in the common parabola, whose property is $t * = y y$, the subtangent is in length equal to $x$, the absciss, multiplied by $y$, the exponent of the power of $y y$, the square of the ordinate; that is, it is equal to twice the absciss: and by the former rule for paraboliform figures, it must be taken above the ordinate in the axis produced.

Thus, also, in one of the cubical paraboloids, where $p = x = y y$, the length of the subtangent will be $4 d s$ of the absciss: and in a parabola of any kind, the general equation being $a n = x a = y a +$, the subtangent is $= m + n$ or its ratio to the absciss is constantly that of $m + n$ or $n$. See Method of Tangents.

In the parabola, the subtangent $PT$ is double the absciss $AP$; and the subnormal $PR$ is subduple of the parameter.

SUBTENSE, formed from sub, under, and tendo, to stretch, in Geometry, a right line opposite to an angle, and presumed to be drawn between the two extremities of the arch which measures that angle.

The subtense of the angle coincides with the chord of the arc.

In every right-angled triangle, the square of the subtense of the right angle is equal to the squares of the subtenses of both the other angles, by the 47th prop. of Euclid. See HOMOTHETUS and TRIANGLE.

SUBTURGES, in Geography, a town of Hindoozian, in Oude; 22 miles E. of Luckow.

SUBTURMOOK, a river of Bengal, which runs into the bay of Bengal, N. lat. 21° 55'. E. long. 88° 30'.

SUBTERRANEUS, or SUBTERRANEAN, something under ground.

Naturalists talk much of subterranean fires, as the cause of volcanoes; and subterranean winds, as the cause of earthquakes.

Among the many places where subterranean fires are found, England is not wholly without them; though with us they appear only in the coal countries, and plainly feed on nothing but the upper stratum of the coal, called by the miners day-coal, unless where they have by accident been kindled.
kindled by actual fires at great depths, or fired downward, by being pent in for room. See VOLCANO.

We have an account in the Philosophical Transactions, of a subterranean town found at Portici, near Naples, in which many ancient statues, paintings, and other curiosities have been found. This subterranean town is probably the ancient city of Herculanum, which was swallowed up by an earthquake. See Phil. Trans. No 458. sect. 4, 5, and 6.

It is remarkable, that some of the ancient statues found there are as fresh and perfect, as if lately painted. Ibid. sect. 6. See Herculanum.

SUBTILE, in Physic, intimates a thing exceedingly small, fine, and delicate; such as the animal spirits, the effluvia of odorous bodies, &c. are supposed to be.

One kind of matter is only more subtile than another, in that, being divided into smaller parts, and those too more agitated; on the one hand, it makes less resistance to other bodies; and, on the other, inflates itself more easily into their pores. The Cartesians suppose a subtile matter for their first element. See CARTESIAN, and MATERIA SUBTILIS.

SUBTILIZATION, SUBTILIZATIO, the act of subtilizing, or rendering anything smaller and subtiler; particularly, the dissolving or changing of a mixt body into a pure liquor, or a fine powder, by separating the groarser parts from it.

SUBTRACTION. See SUBTRACTION.

Subtraction of Conjugal Rights, in Law, is where either the husband or wife lives separate from the other without sufficient reason; in which case the ecclesiastical jurisdiction, on a suit for restitution of conjugal rights, will compel them to come together again, if either party be weak enough to desire it, contrary to the inclination of the other.

Subtraction of Legacies, denotes the witholding or detaining of legacies, for which the spiritual court administrators redress, by compelling the executor to pay them. But in this case, the courts of equity exercise a concurrent jurisdiction with the ecclesiastical courts, as incident to some other species of relief prayed by the complainant; so to compel the executor to account to the testator's effects, or to the legacy, or the like.

Subtraction, with regard to real Property, is an injury which happens, when any person, who owes any suit, duty, custom, or service, to another, withholds or neglects to perform it. It differs from a diffe[m], (which see,) in that this is committed without any denial of the right, confining merely in non-performance; that strikes at the very title of the party injured, and amounts to an ouster or actual dispossession. (See OUSTER.) Subtraction, however, being a clearly an injury, is remediable by due course of law; but the remedy differs according to the nature of the services; whether they be due by virtue of any statute, or by custom only. (See Blackf. Comm. vol. iii.

Subtraction of Titles, is the witholding of titles from the parson or vicar, whether the former be a clergyman or a lay appropriator. (See TITLES.) In this case, luminary and expiatory affiance is given by the statutes of 27 Hen. VIII. cap. 20, and 32 Hen. VIII. cap. 7, which enact, that upon complaint of any contempt or misbehaviour to the ecclesiastical judge by the defendant in any suit for titles, any privy-counselor, or any two justices of the peace (or in case of disobedience to any definitive sentence, any two justices of the peace) may commit the party to prison without bail or mainprize, till he enters into a recognizance, with sufficient sureties, to give due obedience to the process and sentence of the court. Blackf. Comm. vol. iii.

SUBTRAY, or Meniere en Brenne, in Geography, a town of France, in the department of the Indre; 9 miles S. of Chartillon.

SUBTRIPLE RATIO. See Ratio.

SUBU, in Geography. See SIBBOO.

SUBVERSIO STOMACHI, a term used by some authors to express a violent vomiting, when what should pass through the intestines is voided constantly by the mouth.

SUBULARE FOLIUM, among Botanists. See LEAF.


Gen. Ch. Cal. Perianth inferior, of four, ovate, concave, spreading, deciduous leaves. Cor. cruciform, of four, obovate, undivided petals, rather larger than the calyx. Stam. Filaments fix, not so long as the corolla, the two shorter ones opposite; anthers minute. Fil. Germinfer superior, ovate; style shorter than the pouch; stigma obtuse. Peric. Pouch ovate, compressed, entire, tipped with the short style, of two cells; the partition contrary to its greater diameter; valves ovate; deeply concave. Seeds very small, roundish.

Eff. Ch. Pouch entire, elliptical, of two, deeply concave valves. Partition contrary to the greater diameter of the pouch. Style very short.


We have followed Wildenow in making this a species of Subularia, from Scopoli's description.

SUBULATED LEAF. See LEAF.

SUBULGUR, in Geography, a town of Hindoostan, in the circuit of Gohud; 20 miles S. of Kerowly.

SUBULO, a term used by Pliny for two years old. See FERULA.

SUBULO, in Natural History, a word used by the ancients to express a deer, or stag, at that time of its life when the horns first begin to appear.

Others have understood it as the name of the oryx, whose horn was narrow at the summit, and thence gradually larger toward the base; so that it resembled the figure of the fibulo. This is the fabulous creature called the unicorn, and described as a nimble and terrible animal. But it is certain that no such animal ever existed, as is called by this name, and it is thus described: the one-horned animal in the
the world is the rhinoceros, and this is an unwieldy heavy animal, not at all resembling the characters or figures we have of the fabulo, or oryx.

It is to be observed, that the fabulo of the most ancient writers was an instrument of iron, sharp at the point, used in the Rome-queries to break a way through large masts.

Suburbanus, Suburbanus, formed from sub, under, and urbs, city, an epithet given to those provinces of Italy, &c. which composed the ancient diocesi, or patriarchate of Rome. They were also sometimes called urbaria provinces.

Authors usually reckon ten of these suburbanus provinces; of which Italy, from the Po to the heel, made seven; and the isles of Sicily, Sardinia, and Corsica, the other three.

Yet Salamanus will have the suburbanus provinces confined to those four in the neighbourhood of Rome, to which the authority of the prefect of Rome extended; and these he makes the limits of the diocese of ancient Rome.

F. Sirmond takes the other extreme, and comprehends all the West under the name of suburbanus provinces.

Rufinus, who lived in the age of the council of Nice, explains the power ascribed to the pope, in the fifth canon of that council, by saying, that he had the care and superintendence of the suburbanus provinces. Hence the different sentiments of authors, with regard to the suburbanus provinces; some only conferring the pope as bishop of Rome; others as patriarch of the West, &c.

- Suburbs, buildings without the walls or compas of a city or town.

SUC Samhil, in Geography, a town of Peru, in Chusitan, 70 miles S. of Toifar.

SUC Aife, a town of Arabia, in Hedjas; 25 miles S. E. of Jambo.

SUCCADA, a town of Tripoli, in the gulf of Sidra; 45 miles S. E. of Medurada.

SUCCEADA, a town of the island of Borneo, and capital of a kingdom of the same name, at the mouth of a river. The chief products of the country are camphor and diamonds. S. lat. 6° 56'. E. long. 109° 56'.

Succesdaneum, formed from succeso, to succeed, in Pharmacy, a remedy substitutit in the place of another first prescribed, when the ingredients are wanting necessary for the composition of that other.

Substituta and sucedaneum are of equal import; unless with some authors we choose to use a substitute, where a simple of like virtue is put for another; and sucedaneum where a compound is used with the same intention for another compound.

Succenturiati Renes, in Anatomy, the renal capsules, as if they were subsidiary kidneys. (See Kidney.) The same epitaph is also given to the small additional spleens, when they occur.

Succenturiation, the act of substituting. See Substitution.

Success, in Geography, an uninhabited township of New Hampshire, in Grafton county, N. E. of the White mountains, on the E. line of the state, incorporated in 1773.

Success Bay, or Good Success Bay, a bay on the S. E. coast of Terra del Fuego, in the Straits of Le Maire. On the mountains inland of this bay, Mr. (now Sir Joseph) Banks and Dr. Solander found many new alpine plants, unknown in Europe; but the cold was so intense, that the latter had nearly fallen a sacrifice to its severity in the midst of summer. Dr. Solander, who had more than once crossed the mountains which divide Sweden from Norway, well knew that extreme cold, especially when joined with fatigue, produces a torpor and sleepiness that are almost irremediable: he therefore con- jured the company to keep moving, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest: whatever its downs, says he, will sleep; and who soever sleeps, will wake no more. Dr. Solander himself was the first who found the inclination, against which he had warned others, irremediable; and insinced upon being suffered to lie down. Mr. Banks intreated and re- monstrated in vain; down he lay upon the ground, though it was covered with snow, and it was with great difficulty that his friend kept him from sleeping. Richmond also, one of the black servants, began to linger, having suffered from the cold in the same manner as the doctor. Mr. Banks, there- fore, at first five of the company, one by one, Mr. Bed- chan, forward, to get a fire ready at the first convenient place they could find, and himself and four others remained with the doctor and Richmond, whom partly by persuasion and intreaty, and partly by force, they brought on, till they both declared they could go no farther. Mr. Banks had recourse to intreaty and expostulation, but they pro- duced no effect: when Richmond was told, that if he did not go now he would in a short time be frozen to death, he answered, that he defied nothing but to lie down and die. The doctor did not so explicitly renounce his life; he said he was willing to go on, but that he must first take some sleep, though he had before told the company that to sleep was to perish. Mr. Banks and the rest found it impossible to carry them, and there being no remedy, they were suffered to lie down, being partly supported by the buffets, and in a few minutes they fell into a profound sleep: soon after, some of the people who had been sent forward returned with the welcome news that a fire was kindled about a quarter of a mile farther on the way. Mr. Banks then endeavoured to wake Dr. Solander, and happily succeeded; but though he had not slept five minutes, he had almost lost the use of his limbs. Mr. Bed- chan, the muscles were so shrunk, that his shoes fell from his feet; he confessed to go forward, with such anattisance as could be given him, but no attempts to relieve poor Richmond were successful. Richmond, and a feaman sent to his relief, died. S. lat. 54° 50'. W. long. 65° 27'.

Cape Success in this bay at the point lies in S. lat. 55° 17'. W. long. 65° 27'.

Succession, Successio, in Philosophy, an idea which we get by reflecting on that train of ideas constantly following one another in our minds when awake.

The distance between any parts of this succession, is what we call duration (which see). When this succession of ideas occurs, we have no perception of time, or of was duration, but the moment we fall asleep, and that in which we awake, seem connected.

They who think we get the idea of succession from our observation of motion by our senses, will adopt Mr. Locke's sentiment above stated, when they consider that motion produces an idea of succession no otherwise than by producing a continual chain of dizziness ideas.

A man that looks on a body moving, perceives no motion, unless that motion produces a constant train of suc- cessive ideas. But wherever a man is, though all things be at rest about him, if he thinks, he will be conscious of succession.

Succession of the Signs, in Astronomy, is the order in which they follow each other, and according to which the sun enters, successively, into one, then into another; called, also, constantia. This
This order is expressed in the following technical terms:

"Sunt Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Arcitesens, Caper, Amphi, Pilces."

Or, in English:

"The Ram, the Bull, the heavenly Twins, And next the Crab, the Lion shines, The Virgin and the Scales; The Scorpion, Archer, and He-goat, The man that holds the watering pot, And Fifth with glittering tails."

When a planet is direct, it is said to go according to the order and succession of the signs, or in consecventia; that is, from Aries to Taurus, &c. When retrograde, it is said to go contrary to the succession of the signs, or in antecedentia, or from Taurus to Aries, &c.

Succession, in the Civil Law, implies a right to the whole effect left by a defunct.

Of this there are several kinds, ab-intestate, intestate, &c.

Succession ab-intestate, is that which a person has a right to by being next of kin, which is what we call, being next heir at law.

Succession intestate, is that in which all the effects are divided among the heirs, in equal parts. In such cases of intestate succession, the laws of the Roman law of succession ab intestate, the general rule of which succession was this:

1. The children, or lineal descendants, in equal parts. 2. In failure of these, the parents, or lineal descendants, and with them the brethren, or sisters of the whole blood; or, if the parents were dead, all the brethren and sisters, together with the representatives of a brother or sister deceased. 3. The next collateral relations in equal degree. 4. The husband or wife of the deceased.

Succession, Testamentary, is that in which a person comes by virtue of a will.

Succession in the direct Line, is that coming from ascendants, or descendants. See Line.

Succession, Collateral, is that coming by uncles, aunts, or other collaterals. See Collateral.

Succession, Adjacent, or Abandoned, is a burdenome or vexatious one, which no body will accept of. There is no real succession in benefices; for, here nobody inherits.

In effects that cannot be divided, as kingdom, &c., the succession falls on a single head; which is usually the eldest son of the deceased, as being the indivisible representative of his father.

In effects that are divided, all the children represent their father. It was on this principle, M. Courtin observes, that each of the sons of Jacob had his share assigned him in the Land of Promise. It is true, Manassieh and Ephraim, the two sons of Joseph, had likewise their shares; but this was because a double portion had been allotted their father, wherein he was treated as elder brother, in consideration of the great services he had done his father and brethren.

Succession to the Crown. See Crown.

Succession, in Agriculture, a term applied to the order in which crops, or what occupies the fields, whether arable, lays, or fallows, succeed each other in, in the different fields.

Succession of Crops and Cropping, in Agriculture and Gardening, such as are put in so as to come in due or proper succession. See Crops, Course of, and Rotation of Crops.

A very useful and advantageous succession of cropping, in garden culture, is stated, in a paper in the "Memoirs of the Caledonian Horticultural Society," to be that of beginning with celery, which is planted on poor run-out parts of the ground, formed into ridges seven feet in breadth, and five between them, allowing three on each side; the space of seven feet is then cast out in making them to the depth of a spading and the shovellings, the earth being laid equally on each side, and filling the ridges with good dung; the thickness of a foot; which, after it is smoothed, and well trodden in, is covered, in the whole, to about the depth of four inches, with the mouldy earth thrown out; the celery plants being carefully set out across the ridges, about fourteen inches row from row. The crop will thus, it is said, when fully earthened up, stand four or five feet from the top to the bottom of the ridge. These ridges are supposed to have several advantages over single rows, the mode usually practised, as by digging so deep, there is in the course of blanching a great quantity of new earth mixed with the old surface and dung; and the celery is kept more dry and free from rotting in the winter. The ridges may be planted at different times, so as to come in well for winter and spring crops.

The next season after this crop, the ground may be planted with cauliflower and red beet; in that which succeeds that, it may be sown with onions; and in the fourth year, the ground may be cropped with turnips. All these crops are capable of being raised with perfect success, in succession after the celery, without any further manuring.

SUCCESSIVE ACTIO, in Law. See Action.

SUCCESSOR, a person who holds a place which another held before him; whether he arrived at it by election, collation, inheritance, or otherwise.

The king of the Romans is presumptive successor to the empire.

The canonists say, a codjutor is a necessary successor to a prelature; a refugee to the refugite.

Civilians say, a titular usufructuary can do nothing to the prejudice of his successor.

SUCIFERA VARA, in Natural History, a name given by those who have written of the anatomy of plants, to those vessels which contain the juices, by way of distinction from those which only give passage to the air, and are called trachee.

Leeuwenhoek tells us that the microscope discovers the succiferous vessels of plants to be, in all respects, analogous to those of animals, and that they are of two kinds, veins and arteries; the latter receiving the juices from the root, and carrying them all over the plant; and the others receiving the juice from their extremities, and carrying it back again to the root, where it is again delivered to the arteries.

SUCCINATS, in Chemistry, salts formed by the combination of any base with the succinic acid.

SUCCINIC ACID, is an acid that rises during the dry distillation of Amber (which see), partly in the form of spicular crysftals, which attach themselves to the neck of the retort, and partly dissolved in the volatile oil, which rises at the same time. In this state the acid is of a dark yellowish-brown colour, being contaminated by the oil, and requires successive rectification before it can be obtained tolerably pure. Two methods have been practised of purifying the acid; the first is, to mix the brown concrete acid with lands, or which is still better, with dry unburnt white clay, free from calcareous earth, but properly to sublimation by a very gentle heat; the clay detains the mother of the oil, and the acid rises to the upper part of the vessel, where it forms light-brown needle-shaped crystals. The second, and more economical way, recommended by Pott, is first to wash the oil in warm water, in order to separate the acid held by it.
SUC

in solution; then, after pouring off the oil, to add the solid acid, and heat the water till the whole of it is dissolved: a filter of cotton wool moistened with oil of amber being now prepared, the hot solution is run through it; the oil is principally detained by the filter, and the fluid as it cools deposits long slender crystals of succinic acid, which may be rendered still purer by subsequent solution and filtration, or still more effectively, according to Löwitiz, by the following method: Make a saturated solution of the solid acid in hot water, and add a quantity of finely pulverized fresh burnt charcoal, equal to half the weight of the acid; strain the solution through a filter of charcoal powder, and as the liquor cools the acid will be deposited in long, clear, perfectly colourless crystals.

According to the German chemists, the proportion of acid yielded by amber is about one-thirtieth of its weight; the French, on the other hand, have not, in general, been able to obtain more than one-sixtieth.

Purified succinic acid is very acid to the taste, though not corrosive; in very cold water it is scarcely at all soluble, requiring from 24 to 30 times its weight of this fluid at 50° Fahr. for its solution; of boiling water, however, three parts are sufficient. The form of its crystals is that of truncated three-sided prisms, or, when prepared in the manner recommended by Lowitz, of thin four-sided tables.

A gentle heat is sufficient to volatilize this salt; it rises in white vapours like carbonated ammonia. It is neither efflorescent nor deliquescent when exposed to the air.

The bale of succinic acid is a compound combustible, one like the vegetable acids: it burns when exposed to the blow-pipe, detones with nitre, and when succinat of potash is heated in close vessels, a large quantity of carburetted hydrogen is given out, and carbonated potash, mixed with charcoal, is left behind.

Boiling alcohol dissolves succinic acid in the proportion of 117 grains to an ounce, which is almost wholly deposited as the liquor grows cold. If the impure acid is dissolved in alcohol, and 6 times the quantity of cold water is added, the mixture becomes turbid and milky, from the separation of the oil; and if in this state it is thrown upon a filter, a clear fluid holding the acid in solution passes through, and the oil remains behind on the filter.

Nitrice acid dissolves the succinic acid, but does not convert it into what was supposed by Wetzelt.

Potash combines readily with succinic acid, forming a neutral salt.

Succinat of potash, crystallizing in truncated tridreral prisms, which are somewhat deliquescent in the air, are readily soluble in water, have a bitterish saline taste, and decrепitate on hot coals. Its acid is destroyed by heat, leaving the alkali in a carbonated state.

Succinat of soda differs from the former salt, in being permanent in the air, and less soluble in water.

Succinat of ammonium forms needle-shaped crystals of a sharp saline bitter taste: it may be volatilized and sublimed without decomposition. The fixed alkalies disengage the ammonium, and unite with the acid.

Succinic acid with lime and barytes forms salts of difficult solution in water. It unites with magnesia in a gummy uncrystallizable mass.

The affinities of succinic acid have not been determined with any accuracy, on account of the difficulty of obtaining it pure, for any mixture of oil with the acid will greatly modify its action on other salts. According to Mureveau, barytes has the most powerful attraction for succinic acid, after which come lime, the fixed alkalies, ammonium, and magnesia.

Green arranges the affinities of succinic acid in the following manner: it decomposes in the moist way all the carbonated alkalies and earths.

All the earthy and alkaline succinates are decomposed by sulphuric acid.

The alkaline succinates are also decomposed by nitric, and muriatic, and florid acids, but nitrates, muriates, and fluorides of lime and barytes, are decomposed by succinic acid.

The boracic, benzoic, and acetic acids, are inferior in affinity to the succinic acid. Aitkin's Dict. of Chem. and Min. vol. i.

SUCCINUM. See Amber.

SUCCISA, in Botany, an old name for a common European species of Scania, (see that article,) whose root has the appearance of having been topped off at the bottom.

SUCCONEDE, in Geography. See Sukkonda.

SUCCOOT, a town of Nubia, on the Nile; 10 miles N. of Dongola. Lat. 22°. Long. 31° 40'.'

SUCCOREY, in Botany and Gardening. See Chichorium.

Succory, Gum. See Chondrella.

SUCCTORINE ALOES. See Aloes.

Succour, in the Military Art, denotes assistance for relieving a place, that is, raising the siege and forcing the enemy from it.

SUCCUBUS, or Succula, a term used by some visionary writers to signify a demon, or spirit, who assumes the shape of a woman, and, as such, lies with a man.

Some authors use incubus (which see) and succubus indiscriminately; but they ought to be distinguished: incubus being only properly used, where the demon is supposed to be in form of a man, and, as such, lies with a woman.

SUCCULATA, in Mechanics, an axis, or cylinder, with flares in it to move it round; but without any tympanum, or peritrochium.

SUCCULENT, in Agriculture, a term signifying rich, juicy, moist, &c. when applied to such plants and roots as are of that nature.

It has been remarked by Sir Humphrey Davy, that all green succulent plants contain fuchsine or mucilaginous matter, with woody fibre, and readily ferment. They cannot, therefore, it is supposed, if intended for manure, be used too soon after their death or destruction. When such green crops are to be converted to the purpose of enriching a soil, they should be turned into it, if possible, when they are just in flower, or at the time they are beginning to form and shew their flowers, as it is at this period that they contain the largest quantity of easily soluble matter, and their leaves are the most active in forming nutritive matter in such situations. These green crops, the weeds of ponds, the parings of dyke and ditch-fences, or the parts of any kind of fresh vegetable matter, require no preparation for fitting them for manure. The decomposition of them is thought to go on slowly beneath the soil; the soluble matters are gradually dissolved; and the flight fermentation that takes place being restrained by the want of a free communication of air, tends to render the woody fibre soluble, without occasioning the rapid diffraction of elastic matter.

In the case of breaking up old graves, and rendering it arable, the foil is not only enriched by the death and flow decay of the plants which have left soluble matters in the foil; but the leaves and roots of the grasse which are living at the time, and occupying a large part of the surface, afford, it is said, fuchsine, mucilaginous, and extractive matters, which become immediately the food of the crop, and the gradual decay and decomposition of which yield a supply for successive years.

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The two former of these matters, when contained in a pretty full proportion in these kinds of plants and roots, render them highly nourishing also for food animals.

**Succumi,** in Geography, a town of Japan, in the island of Ximo; 25 miles S.W. of Fumai.

**Succunérah,** a town of Hindooftan, in the fubah of Agra; 46 miles S.E. of Etayah.

**Succus Pancreaticus.** See Pancreatic Juice.

**Succus Nervosus.** See Nervous Fluids, &c.

**Succusary,** in Geography, a town of New Jersey; 24 miles N.N.W. of New Brunswick.

**Sucharew,** a town of Ruflia, in the government of Upfa; 52 miles N. of Melznellik.

**Suchipila,** a town of Mexico, in the province of Guadaljara; 42 miles S. of Guadalajara.

**Suchitepec,** or St. Antonio de Suchitepec, a town of Mexico, in the province of Suconnce, on a river which runs into the Pacific ocean; 60 miles W.N.W. of Guatimala. S. lat. 14° 44'. W. long. 93° 36'.

**Suchona,** a river of Ruflia, which rises in lake Kubenicoon, and runs into the Dwinia, near Ufing.

**Suchotzko,** a town of Ruflia, in the government of Newwrood; 52 miles E.S.E. of Tschwien.

**Suchetein,** a town of France, in the department of the Roe; 21 miles N. of Juliers. N. lat. 51° 15'. E. long. 6° 14'.

**Suck,** a river of Ireland, which runs into the Shannon, about six miles S.E. from Balinafoe, separating the counties of Galway and Roscommon during a course of thirty miles.

**Suck creek,** a river of America, in Teneffee, which discharges itself into the Suck or Whirl, a few miles N. of the Georgia north line.

**Suckalton,** a town of Hindooftan, in the circe of Scharunpou; 21 miles E.N.E. of Merat.

**Sucksunny,** a town of America, in New Jersey; 12 miles W. of Morrittown.

**Sucker,** or Suck-Fish, in Ichthyology. See Remora.

'Sucker is also a name given to the lump-fish.

**Sucker, Bimaculated,** is a new species of sucker discovered near Weymouth, and described by Mr. Pennant. Its head is flat and acuminate on each side; the body taper; the pectoral fins placed unusually high; it has only one dorsal fin placed near the tail; the tail is even at the end; the colour of the head and body is a fine pink, that of the fins whitish; on each side of the belly is a round black spot.

**Sucker, Stone,** the English name of a genus of fish. See Patromyzon.

**Sucker, Unbauer.** See Liparis.

**Sucker, Goat,** in Ornithology. See Caprimulgus.

**Suckers,** in Gardening, such young offspring plants as arise immediately from the roots of older vegetables, and which, being generally furnished also with roots, when transplanted, readily grow, and become proper plants, similar to the mother ones. See Off-set and Sprouts.

The season for taking up or transplanting suckers of trees and shrubs, is almost any time, in open weather, from October till March, being careful to dig them up from the mother-plant with as much and many root-fibres as possible, and trimming them ready for planting, by shortening the long fraggling fibres, and cutting off any thick-nobbed part of the old root that may adhere to the bottom, leaving only the fibres arising from the young wood; though it is probable some will appear with hardly any fibres; but as the bottom part, having been under ground, and contiguous to the root of the main plant, is naturally disposed to send forth fibres for rooting; preparatory to planting them out, the items of the shrub and tree-suckers should likewise be trimmed occasionally, by cutting off all lower laterals; and any having long, slender, and weak tops, or such as are intended to assume a more dwarfish or bulbous growth, may be shortened at top in proportion, to form about half a foot to one or two feet in length, according to their nature or strength; and others that are more strong, or that are designed to run up with taller items, may have their tops left entire, or shortened but little: when thus taken up and trimmed, they should be planted out in rows in the nursery; the weak suckers separately in close rows; and also the shortened and stronger plants, each separately in wider rows; so that their rows may be from one to two feet asunder, in proportion to the size and strength of the suckers; and after being thus planted out, they should have the common nursery-culture of cleaning from weeds in summer, and digging the ground between the rows in winter, &c. and in from one to two or three years they will be of a proper size for planting out where they are to remain: and some kinds of trees, large shrubs, &c. produce suckers strong enough in one season to be fit for planting where they are to remain; as well as some forces of roes, and most kinds of other flowering shrubs; also some plants of the strong shooting gooseberries, currants, rafberries, and others of similar kinds.

It may generally be observed of such trees and shrubs as are naturally disposed to send up many suckers, that by whatsoever method they are propagated, whether by seeds, suckers, layers, cuttings, &c. they commonly still continue their natural tendency in this respect. When it is, therefore, required to have any sorts to produce as few suckers as possible, not to over-run the ground, or disfigure the plants, it is proper, both at the time of separating the suckers, or planting them off from the main plants, and at the time of their final removal from the nursery, to observe if at the bottom part they shew any tendency to emit suckers, by the appearance of prominent buds, which, if the case, should all be rubbed off as close as possible: as, however, many sorts of trees and shrubs are liable to throw out considerably more than may be wanted, they should always be cleared away annually at least, and in such as are not wanted for increasing, it is proper to eradicate them constantly, as they are produced in the spring and summer seasons.

Also numerous herbaceous and succulent plants are productive of bottom offset suckers from the roots, by which they may be increased.

In lifting and planting these sorts of offset suckers, the smaller ones should be planted in nursery-beds, pots, &c., according to the nature of growth and temperature of the different sorts, to have the advantage of one summer's advanced growth; and the larger ones be set at once, where they are to remain, in beds, borders, pots, &c., according to the different sorts or descriptions of them.

The suckers of many of the finer kinds of flower-plants, as in the auricula and others, may be separated or taken off from the parent plants any time between the months of February and that of August, as they may become of a proper size, or be wanted for increase; but if they be not wanted for this use, they should never be suffered to remain. They can often be clipped off by the fingers, or a sharp piece of wood, without removing much earth, or the plants from the pots; but when they are large, and cannot be thus separated with a sufficient number of fibres to their bottom parts, they may be taken out of the pots, and be removed by the knife without danger, which is perhaps the best way, as affording most fibres. The suckers of such old flower-plants, when they are wanted to blow strong, should
should always be taken off without disturbing the plants in the pots, especially when they are few. The suckers, in all cafes of this sort, should constantly be planted as soon as possible after they are fluffed, in proper small upright pots, giving a light watering at the time, with suitable temporary shade. They should be placed in proper situations out of the droppings of trees. They thus soon become strongly rooted. The suckers of such flower-plants must, however, never be removed after the latter of the above periods, as they have then done shootting, and are become inactive, and as the winter immediately succeeds, fiodo do well, especially without great care and trouble.

Timber-trees, in some cafes, as in the elm, may be beneficially propagated by suckers, as producing better and more found timber, than by raising them in other ways. The suckers, in such cafes, should be separated from the horizontal roots of the old trees at an early period, and be then planted out, when they will soon take firm root and become good trees.

SUCKEREE, in Geography, a town of Hindooftan, in Bundelcund; 8 miles S. of Pannah. See Pannah.

SUCKING PUMP. See pump.

SUCKLER, in Rural Economy, a term applied to a calf which is used for the purpose of sucking, or being made fat.

SUCKLING, a term applied to the art of fattening calves, lambs, &c. by means of milk. (See calf and lamb.) It also signifies a fort of white clover.

Sucking, Sir John, in Biography, an English poet, was born at Witham, Essex, in 1614, and is said to have possessed such natural talents, that he spoke Latin at the age of five years, and wrote it at nine. He chiefly devoted himself to music and poetry. Having finished his studies at home, he travelled abroad for farther improvement, and made a campaign under Gustavus Adolphus, in which he is said to have been present at five sieges, three battles, and some skirmishes. Upon his return to England, he appeared the accomplished gentleman and courtier, and excited admiration by his sprightliness and gallantry. Associating with wits and poets, he composed some dramatic pieces for the amusement of the court; and such was his prodigality, that when he brought his tragedy of "A Clandestine Marriage" on the stage, he expended four or five hundred pounds. Whilst he drew attention in the gay period of that reign by his poetical effusions and courtly manners, he affected to be indifferent to literary fame. When the troubles of this reign began, he evinced his loyalty by raising a troop of horse at the expense of 12,000L, placing himself at their head. On this occasion he incurred a disgrace which was trumpeted in ballads and squibs by his brother poets, and which is supposed to have tarnished his death in 1651, when he had arrived only at the 28th year of his age. Sucking has no claim to distinction among the British poets; though, if he had bestowed greater care and correctness on some of his fongs and ballads, they might have served as models of that class of compositions. His "Wedding Ballad" has always been popular; and the fancy and wit that sparkle in some of his amatory pieces attract notice. His plays, which are four in number, have long disappeared from the stage. His collected works, in prose and verse, have passed through several editions; the last appeared in 1774. 2 vols. 12mo. Life of Sucking, prefixed to his Works.

Sucking, Cape, in Geography, a cape on the N.W. part of North America, off which, and to the N.E. end of Kaye's island, is a muddy bottom with from 43 to 37 fathoms of water. The S.W. point of Kaye's island is in N. lat. 59° 40', and W. long. 143° 21'.

SUCKREE, a town of Hindooftan, in the circar of Ruttunpour; 8 miles N.W. of Ruttunpour.

SUCKRY, a town of Hindooftan, in Gurry Mundella; 10 miles S.E. of Gurrah.

SUCTION, in Physiology, the act of drawing into the mouth fluids and other substances by means of the preasure of the external air. When an infant is imbibing its food from the breast of the mother, its lips are applied closely to the nipple, so that no air can enter; but by enlarging the chest, the atmospheric preasure is removed from the surface of the nipple, while it still continues on the external surface of the breast; and thus forces the contents of the lactiferous tubes into the mouth. If the lips are immered in any fluid, and the chest expanded, the preasure of the external atmosphere will force it into the mouth. The act of suction, indeed, depending on this atmospheric preasure, is in all cafes essentially the same. See Lung.

Air is sucked through a pipe, in the same manner as with the naked mouth; it being here the same as if the mouth were extended through the length of the pipe. If a man apply his mouth to one end of an open tube, the other end of which is placed in water, the operation of sucking is performed in the following manner. By enlarging his chest, he rarifies the air, and of course diminishes its preasure on the liquor, which is immediately under the tube; in consequence of which, the preasure of the atmosphere on the surface of the surrounding liquor forces the liquor to ascend into the tube.

The suction of heavier liquors is performed after the same manner. e.g. Should one try to drink out of a spraying, &c. the lips are applied close to the surface of the water, so as to prevent any passage of the air between them; then the cavity of the abdomen, &c. being distended as before, the preasure of the air incumbent on the surface of the water, without the circumference of the mouth, prevailing over that upon the water within the same, the fluid is raised from the same principle as water in a pump.

In sucking a heavy liquor, as water, through a pipe, the longer the pipe is, the greater difficulty is found in the suction; and the bigger and diameter of the pipe makes a farther alteration therein. The suction of this arises from that great principle in hydrostatics, that fluids press in the compound ratio of the bales, and perpendicular altitudes.

From what we have said, it evidently enough appears, that what we call suction is not performed by any active faculty in the mouth, lungs, &c.; but by the mere impulse and preasure of the atmosphere.

A very curious and intelligent person distinguishes two different sorts of suction, performed after two quite different manners; a distinction which, however hitherto overlooked by authors, seems absolutely necessary.

Suction, then, according to him, is performed either, 1st, by the dilatation of the thorax; or, 2dly, by that of the cavity of the mouth.

In the former case, the lungs are kept continually distended; for if the breath be let go ever so little, the liquor in the tube will begin to subside.

On the contrary, when suction is performed by enlarging the cavity of the mouth, we may suck with our utmost force, and yet breathe freely through the mouth; so that this is the true proper suction; the other ought rather to be called sipping than sucking through a tube.

Note, the cavity of the mouth is enlarged by being a little...
SUCU, in Botany, a species of apple-tree, said to be frequent in the province of Canton, in China. The fruit is dried like figs to be kept all the year, and is brought into Europe. It is somewhat larger than our apple, almost round, and of a reddish colour, or sometimes green. When it is dry, it has a crust resembling honey or sugar.

SUCULA, in Maronitis. See Succula.

SUCY, in Geography, a town of France, in the department of the Seine and Oise; 10 miles N. of Corbeil.

SUCZAVA, or SUCHZOW, a town of Bukovina, on a river of the same name, formerly flourishing, and the capital of the country, in which were reckoned 60 churches, but now much declined from its former splendour; 84 miles N.W. of Jaffa. N. lat. 47° 57'. E. long. 25° 58'.

SUCZAVITA, a town of Bukovina; 30 miles W. of Suczava.

SUD, a river of Russia, which runs into the Schekha, 8 miles E. of Tcherepoeza, in the government of Novgorod.

SUD, Gulf of, a spacious natural harbour, one of the finest and safest of the Archipelago, lies to the south of a peninsula in the island of Crete. Its mouth is to the east, and its head runs to the W.N.W. It is not only sheltered by the angles and capes which the lands form, but also by the two islands of Suda; on one of which is situated a fort constructed by the Venetians, 8 miles E. of Canea, and which they preferred for a long time after the island was no longer in their possession. It was not till the reign of Achmet III. that the Turks made themselves masters of this fort, and thus became the tranquill possiessors of the whole island of Crete. The anchorage most frequented by the commanders of vessels, who with only to shelter themselves from a gale of wind, is to the S.S.W. of Cape Maleca, behind a small island known to mariners under the name of "Old Suda." Large ships of war anchor at all places, either at the entrance of the gulf, or by the side of the island just mentioned. Both of them go to the head of the gulf only, when they are to remain for a long time at the anchorage. The boats belonging to the country sometimes anchor between the two islands of Suda.

SUDAK, a sea-port of Russia, in the province of Tauris, on the coast of the Black sea; 20 miles S.W. of Theodosia.

SUDAMINA, little heat-pimply in the skin, like millet-grains, frequent in youth; especially those of a hot temperament, and that use much exercise.

SUDARIUM, in Ecclesiastical Writers, the name with Brandeum; which see.

SUDASEER BULGAR, in Geography, a town of Hindoostan, in Myrore; miles W.S.W. of Ferapatan.

SUDATORY, SUDATORIUM, a name given by the ancient Romans to their hot or sweating-rooms; sometimes also called laconica.

The sudatory was a species of their hypocausta or roves. See Hypocaustum. See also Sweating-House.

SUDBURY, in Geography, a borough-town of great antiquity, in the hundred of Baberg, and county of Suffolk, England, is situated on the south-western side of the river Stour, which is at this place navigable for barges, and over which there is a well-built stone bridge. Sudbury was at one period a place of much greater importance than at present. It comprehends three parishes, the population of which, in 1811, was estimated at 3471 inhabitants, dwelling in 589 houses. The name of this borough was originally Southburgh, to distinguish it from Norwich, then called Northburgh; and was one of the first places at which king Edward III. settled the Flemings, whom he invited to England to instruct his subjects in the woollen manufacture. This flourished here for some centuries, and afforded subsistence to many of the inhabitants of the town, who were employed in weaving of fays, coarse, and ship's flags. Sudbury has still a manufacture of fays, and a small one also of silk, which was established by the London mercers. In this town was born Simon de Sudbury, archbishop of Canterbury in 1375, who was beheaded by the populace, in the rebellion of Wat Tyler. He erected a part of St. Gregory's church, where he is interred, and also founded and endowed a college on the site of his father's house. Le-land remarks that this prelate, in conjunction with John de Chertley, founded here a priory of the order of St. Augus-
SUDE RWA LLE, a town of Germany, in the duchy of Verden; 6 miles N.E. of Verden.

SUDE TIC CHAIN, a range of mountains in Silesia, being a northern branch of the Carpathian mountains, extending from Jablunka S.E. to Friedberg in Upper Lusatia N.W., nearly 200 British miles in length. This chain has other more minute appellations, the north-west part towards Lusatia being called Rien, the middle part the Koniakow chain, and the south, the Moravian chain. Of this remarkable chain, not much noticed by geographers, the highest peak in the mountains of Rien, or of the giants, is the Schneekoppe, or snow head, in the Bohemian part, the Eule or Owl, and the Zottenberg, suppos'd by some to be the Aeciburghus of Ptolemy, the height of which is estimated at about 1210 Rhenish feet, and consisting entirely of serpentine, with some hornblende. The Moravian division divides into inferior branches, one of which forms a northern boundary of the principality of Troppau. Fabri computes the highest part of the Rien at 4930 Rhenish feet above the sea, and the Zottenberg at 1700.

SUDIS, Esox Sphyrena of Linnaeus, in Ichthyology, a name used by most authors for the sea-pike, a fish called by others lucius marinus, and Sphyrena.

It in some degree resembles the common river-pike, but is thinner in proportion to its length, and in some degree approaches to the acus, or tobacco-pipe-fish, in that particular. Its scales are small, and its nose long, and of a conic form, the under jaw running out a good way beyond the upper, and ending in a sharp point; its mouth is very wide, and yellow within; its tongue large and narrow, and armed with very sharp teeth; each of the jaws is furnished with a single row of large and sharp teeth, and in the middle of the lower jaw is one tooth longer than the rest, which has a hollow in the upper jaw for receiving it; it has two fins on the back, which are both very deeply forked. It is caught in the Mediterranean, and usually swims in shoals together. Its total length is ten or twelve inches; and it is esteemed a very well-tasted fish. Ray.

SUDKEULI, in Geography, a town of Bulgaria, on the Euxine sea; 60 miles E. of Byzantium.

SUDODHANA, the name of the mortal father of Boodh, the great reformer of India. The legends of the Cingalese of Ceylon agree with those of the north of India, in giving this name, or one very like it, to the father of Boodh, or Buddha.

SUDOGDA, in Geography, a town of Ruffia, in the government of Vladimir; 28 miles S.E. of Vladimir. N. lat. 55° 40'. E. long. 40° 54'.

SUDOR, in Medicine. See Sweat.

SUDORANGUINUS, the English Sweat. See Sweating Sicksex.

SUDORIFIC, in Medicine. See Diaphoretic.

SUDZA, in Geography, a town of Ruffia, in the government of Kurisk; 40 miles S.W. of Kurisk. N. lat. 51° 20'. E. long. 35° 14'.

SUE, LA, the appellation of Indians who inhabit the territory west of lake Superior, and the Misisipi. The number of warriors is reckoned at 10,000. Pike, in his recapitulation, states them at 3535, and the whole number at 21,675. See Sioux.

SUG, a river of Atrica, one of the branches of the Bembarogue, in Bengal.

SVEABORG, a fortress of Sweden, in the gulf of Finland, situated about 33 miles from Helingsborg, composed of seven rocky islands, which lie within the circumference of four miles. The principal of these islands is Warg-sa, or Wolf's island, which is 2400 feet in length, and 2000 in breadth,
broadth, and contains the governor's house. The project of surrounding these islands with fortifications was formed by general Ehrenwald, and the work begun in 1749. The works are said to be stupendous, and worthy of the ancient Romans. The walls are chiefly of hewn granite, covered with earth, from six to ten feet thick, and in a few places not less than forty-eight in height. The batteries, which commence on a level with the water, and rise in tiers one above another in all directions, commanding the only channel through which large vessels can fail to Hellingfors, render the possession of an enemy's fleet extremely dangerous, if not impracticable. In the island Wargön is a dry dock, capable of containing eleven or twelve frigates, hollowed in the solid rock, 500 feet long, 200 broad, and 14 deep. It is divided into three equal parts by two brick walls, running lengthways. Each part will contain four frigates, and may be closed with sluice-gates, so that each vessel lies separately from the others. The whole is covered with a wooden pent-houset roof, in order to preserve the frigates from the rain. This houset contains eleven frigates. At one extremity of this dock is a bafi, 200 feet square, closed at each end with sluice-gates, which serves for the entrance and exit of the frigates, and likewise for repair or building ships. At the other extremity is another bafi of the same dimensions for a man of war, which may likewise serve for the passage of the frigates, when the other is employed in repairing or building ships. The magazines for the stores and a battery are built on the edge of the water, which is of sufficient depth to admit each vessel close to the quay, to be equipped without trouble. There is an excellent port for seventy ships of the line, and a small harbour, no less secure, for ten frigates. For the purpose of building and refitting ships at Sveaborg, the Swedes procure oak from Gotland, part of the axe from Finland, hemp and masts from Riga. This fortres may not improperly be called, if completed, the Gibraltar of the north. Coxe's Travels.

SUEG, a town of Sweden, in Harjadal, on the Liufna; 86 miles W. of Sundfjord.

SVEGLIATO, in the Italian Myfic, is used for a brisk, lively, gay manner of fingering or playing. Thus they say, maniera svegliata.

SUEIRO da Coça, in Geography, a river of Africa, which runs into the Atlantic, N. lat. 5° 5'.

SUELDI, in Commerce, a money of account in some parts of Spain. At Alicante, accounts are kept in reals of 24 ducres, and also in libras of 20 soldos, subdivided into 12 ducres; the libra being valued at 32, 33d. silver. In Aragon, a soldo is divided into 8 quartos, or 16 ducres, and the libra is worth 20 soldos, or 42 3d. silver nearly. See Money.

SVELMOE, Geography, a small island of Denmark, near the S. coast of the island of Funen. N. lat. 55° 8'. E. long. 10° 20'.

SUEMEZ, Island of, an island in the Pacific ocean, at the entrance of Puerto de Bayilo Bucareli, about 25 miles circumference. N. lat. 55° 5'. E. long. 216° 59'.

SVENBORGH, a seaport town of Denmark, in the island of Funen, with the harbour in the island; in which are manufactures of wool and linen; 22 miles S. of odense. N. lat. 55° 5'. E. long. 10° 37'.

SUEN-HOA, a city of China, of the first rank, in Pe-tsche-li, near the great wall; 77 miles N. of Peking. N. lat. 40° 38'. E. long. 114° 39'.

SVENSKAHOGARNE, a small island in the Baltic, near the coast of Sweden. N. lat. 59° 28'. E. long. 19° 20'.

SVENTIUNGA, a town of Sweden, in West Gothland; 40 miles E.S.E. of Gothenburg.

SUEA. See MOGADOR.

SUERDFO, a town of Sweden, in Dalecarlia; 20 miles N. of Fahlun.

SUESANY, a town of Hungary; 8 miles W.N.W. of Rofenberg.

SUET, a flourishing village of America, in Massachusetts, the county of Barnstable, and township of Dennis, bordering on Harwich; containing about 36 dwelling-houses, the town of Dennis including 1739 inhabitants. Belonging to this village are five falls of fishermen, and four salt-works, which yield annually upwards of 600 bushels of marine salt, besides 2700 lbs. of Glauber salts.

SFIV, Securn, a kind of fat, found in deer, sheep, oxen, hogs, &c., which, melted down and clarified, makes what we call tallow, used in the making of candles.

The word is formed from the Latin, fistum, ficum, or sevum, which signifies the fame; and these a fust, faws, by reason of the fatness of that beast.

Mutton-fuet is the most conffient of real animal fats; it has some degree of brittleness, and requires a temperature of 127° Fahr. to melt it. In other respects it agrees with animal fats in general. Like thefe, it is emollient; it is sometimes boiled in milk in the proportion of 3J of the fat to 3j of milk, and a capital of the mixture is given occasionally in chronic diarrhoea, where there is much acidity of the contents of the bowels; but its principal use is to give conffidence to ointments and plasters. The "sevum praeparatum," or prepared fuet of the London Ph., is obtained by cutting the fuet in pieces, then melting it by a gentle heat, and pressing it through linen.

Another kind of fuet, which we shall mention in this connexion, is the "axungia porcina" of the Edinb. Ph., the "adesa sulvis" of Dub., the "adesa" of Lond. or the Stock-lard. The lard is chiefly obtained from the flank of the animal. It is freed from the membranes and velvets, by being cut in small pieces, then well washed in water till the water comes off colourless, and afterwards melted with a very gentle heat in a shallow vessel, kept on the fire till the water is wholly evaporated. While still liquid, it is poured into bladders, in which it concretes, and in this state it is brought to market.

Lard is inodorous, tafteless, and white; soft, and nearly semifluid. Exposed to a heat of 97° it melts, and concretes again when cooled. It is insoluble in water, alcohol, and ether: but is dissolved by the stronger acids, being at the same time decomposed; and, like the fixed oils, it combines with the alkalies and forms soap. It is oxidized, if when melted a little nitric acid be stirred into it; and assumes a greater degree of firmness, with a yellow colour. By destructive distillation it affords results very similar to those obtained from the analysis of fixed oil; and appears to be a compound of oxygen, hydrogen, and carbon, in unknown proportions. When lard is long exposed to a warm air, it becomes yellow, emits a fatty odour; and, owing to oxygen being attracted from the atmosphere, the folic acid is formed. This state of rancidity may, in some degree, be removed by washing it with very pure soft water; which during the operation becomes acid, and reddens litmus paper.

Lard is emollient, and on account of its softness and uncоoty, is preferable to fat as a friction, but seldom used for this purpose; and is chiefly employed in the formation of ointments. Its official preparation is the "adesa preparata," or prepared lard. That of the London Ph. is obtained by cutting the fat into small fragments, then
melting it by a gentle heat, and pressing it through linen. The "adeps nullius preparatus," or prepared hog's-lard of the Dub. Ph., is had by cutting fresh lard into small pieces, then melting it by a moderate heat, and straining it by pressing it through a linen cloth. Lard prepared by the dealers, and preferred with salt, is to be melted with twice its weight of boiling water, and well straining the mixture; it is then allowed to cool, when the lard may be separated. The lard in its liquid properties are intended for purging, fuel and lard; but in order to obtain them very pure, they should be washed in water till the water comes off colourless before they be melted. During the melting, the remaining water is evaporated; and that this is the case may be ascertained by throwing a little of the melted fat into the fire, when it will crackle if any water remain. The heat must not be raised above 97°, the melting point of fat; because otherwise the fat is decomposed, rendered acrid, and assumes a yellow colour. This purification is seldom attempted by the apothecaries; as both kinds of fat may be procured very well purified from the dealers. Keep the lard clean, and preserve it from the action of the air, it is, as we have already said, run into bladders in its liquid state. Thomson's Dif. See ADEPS, FAT, and ANIMAL OIL. See also CELLULAR SUBSTANCE.

F. le Compte mentions a tree in China, that bears a kind of fruit or tallow. See TALLOW-tree.

SUETIA, in Ichthyology, a name given by Bellonius, and some other writers, to the nactus, a species of cyprinus, according to the Aredian and Linnaean systems, and differing from the name of the cyprinus major, with the lower standing prominent, in form of a nose, and with fourteen rays in the pinna ani.

SUETONIUS TRANQUILLUS, CAUZ, in Biography, was the son of Suetonius Lensa, a tribune of a legion in the time of Otho, and born about the beginning of the reign of Vespasian, and died after A.D. 117. He is designated by Pliny the younger, as one of the "Scolastici." He was probably a teacher of grammar and rhetoric, composed fictitious pleadings, and perhaps sometimes pleaded real causes. With Pliny he was intimate, and was introduced to him for several purposes. His interest he obtained the dignity of military tribune, and also the "jus trium liberonum," granted to him by the emperor Trajan, though he was childless. He was afterwards sent to the emperor Adrian, though he left this office by his indifferently familiarity with the empress Sabina; an incident which occurred about the year 121, but how long, or in what condition he afterwards lived, no records inform us.

Suidas calls him a "grammatarian," and attributes to him several works; but all are lost, except his Lives of the Caesars, his Lives of eminent grammarians, and a small part of those of eminent rhetoricians. His work of the Lives of the first twelve emperors, down to Domitian inclusively, is one of the most interesting remains of ancient history; for without being distinguished by style or sentiment, it abounds with anecdotes relating to the manners, characters, and incidents of those times, which no where else occur. Some of the facts which he relates have been doubted; but his general character and mode of writing narrates, acquaint him of any intentional misrepresentation, though he indicates a propensity to pay undue attention to vulgar tales and turnip-store. His freedom in exposing the infamy of the Caesars may be politically vindicated on this general principle, "that history affords no leasons more instructive than the crimes and vices consequent upon debastic power." Suetonius's disreputable account of the Christs, whom he calls "genius hominum superfluis nova et malefic," a kind of people of a new and mischievous superstitition, can be attributed only to his ignorance of their doctrines and character. We have many editions of Suetonius; but among the best are reckoned Cufaboni a Boeclaro, 4to. Argent. 1647; Gravi, 4to. Tract. 1672, 1703; Pritca, 8vo. 2 vols. Trag. 1650, and 4to. 2 vols. Leard, 1714; Burmanni, 2 vols. 4to. Amst. 1720; Erati, 8vo. Lipl. 1748; Oudendorpi, 8vo. Lugd. Bat. 1751. Gen. Bioe.

SUEUR, EUSTACHIIUS LE, was born at Paris in 1617, the son of an obscure sculptor; who, upon discovering his son's inclination for painting, placed him as a pupil with Simon Vouet. From this school, the source of all that vitiated the style of art practised in France before the revolution, Le Sueur had the singular felicity of emerging with pure taste; and the firmness to pursue such studies as were most conducives to its improvement; while almost all his fellow students, seduced by the glitter and tinsel of art display, were led by their mangled and ably supported, indeed improved, by Le Brun, floated with the tide of fashion, and were lost in the abyss of frivolity and luxury of forms, and artificial combinations of effects. Had Vouet had many scholars like Le Sueur; or had the latter been duly estimated, and been longer preferred in existence, France might perhaps have justly boasted of her Raphael; and true taste have exalted the brilliancy of imagination so congenial to her children. But the luxurious court of Louis XIV. delighted too much in the pompous display of artifice, to relish the true simplicity of pure art; and too eager a desire for amusement and enjoyment, to feel gratification in those religious or pathetic emotions, which it was Le Sueur's delight to raise.

He appears to have drawn his taste from prints after the compositions of Raphael, as he never was out of his native country; and there were not many pictures of the Roman school at that time in France. It may be fairly said, that a portion of the spirit of Raphael had taken up its abode with him. The fame kind of subject introduced him, and above all he was actuated by the fame devoted to the subject of whatever he undertook. With him, as with Raphael, it led to the composition, and controlled his imagination in the execution of it; as is fully exemplified in his series of pictures on the life of St. Bruno. No work of his, however, places him, as the French writers have done, upon a complete parallel with his great prototype. He lacked the sweetness and fulness of the perfection he aspired to rival; both in drawing and execution, he fell far short of his own ideas; and of colouring, he scarcely caught a glimpse. But good sense and propriety governed his designs; and feeling and sentiment guided his hand; with colour sufficient to convey his ideas without offending; at least in his best works.

The brilliancy of Le Sueur's talents soon caustic their employment; and at the age of 23, (1640,) he was elected a member of the Royal Academy at Paris, and painted upon his admission a picture of St. Paul casting out a Devil. In 1649 he was engaged upon the great work in which his fame principally repose, viz. the Life of St. Bruno, which he painted in 22 pictures, for the conven of the Chartreux in Paris: they were afterwards purchased by the king of France, and now form part of the gallery at the Luxembourg. This celebrated series of compositions has suffered exceedingly by folly or malice, and by the hand of time; and still more, have so severely endured the untouched shallock of picture-cleaners and restorers, that we cannot now form a perfect judgment of their original beauty.
beauty. The compositions remain, but most of the faces of the figures have been re-touched, so that expression is weakened or destroyed; the original colouring, which happily was of necessity simple, has been disturbed; and it would be hard to attach to Le Sueur the defects of their present condition in this respect. There is, however, sufficient evidence in them of this ingenious artist's superior feeling and acquirements. He was only three years employed upon them; and when his youth is considered, they must be regarded as emanating from a mind of no common mould. His largest work is the Condemnation of St. Gervaise and St. Protas, now in the gallery of the Louvre; it was painted soon after thefuries above-mentioned; but is an attempt to combine somewhat of the talent of his master with his own, as if he were controlled by his employers. It is more confused in forms, and stronger and more varied in colour, than his pictures usually are; and is not the better for it. His picture of the Burning of the Magic Books at Ephesus, has infinitely more character and pathos; but is eminently defective in colour; in which quality the pictures of the Muses, painted by him, and in the Gallery also, are far his most perfect productions. He died in the early age of 38, in 1655.

SUEVRE, in Geography, a town of France, in the department of the Loire and Cher; 9 miles N.E. of Blois.

SUEZ, a town of Egypt, situated on a point of land, in the form of a peninsula, on the western coast of the Red Sea. As far back as the time of the ancients it was the ancient Arfinoe; but Volney thinks that Arfinoe was situated further north towards the bottom of the gulf. Browne says, that the ruins of Arfinoe may yet be recognised in a mount of rubbish in the neighbourhood of Suez; and that the spot is now called "Kolmum," and that remains extant of a stone-pipe for conveying water thither from Bir Naba. A rock, he says, on the African side of the gulf, furnishes petroleum, which is brought to Suez, and esteemed a cure for bruises, &c. In crossing the gulf junks before Suez, boats are used at high water, which comes in rapidly to the height of four feet; at other times camels, horses, and men ford it with safety. At Suez he observed, in the shallow parts of the adjacent sea, a species of weed, appearing in the fun-gline to be red coral; and he conjectures that if this was found in considerable quantities at a former period, it may have given its recent name to this sea: for this was the Arabian gulf of the ancients, whose name Erythraeum, or Red sea, was the Indian ocean. This weed may, perhaps, be the *Diothras* of the Hebrews, where it is written, יִשְׁלָמֶשׁ, that is, "Shelmish," their name for this sea. According to this traveller, Suez is a small town, built of burnt bricks, and contains 12 mosques, some of stone, and most of them mean building: there are also several coffee-houses. The houses are so close to one another, that there are only two piazzas into the city, that nearest the sea being open, and the other shut by a very insufficient gate. The only fold buildings are the khans. Scarcely any part now remains of the cattle, which the Turks built upon the ruins of the ancient Kolmum or Kolzoum, the "Clyma" of the Greeks, situated about 300 paces N. of Suez, on the bank of the sea opposite the fort, which leads to the frying of El-Naba. The sea near the town is very shallow; yet there is a small yard for ship-building. Its population is inconsiderable, consisting of a few Greeks and Copts, intermixed with Mahometans. Although the inhabitants are not numerous, here are four or five considerable resident merchants, who have their correspondents at Cairo, and in the towns of Arabia, and conduct the commerce between Egypt and India. These have a proportionable number of dependants, and persons who manage commercial affairs of a less considerable kind. Here are also ship-builders, and several other artisans; a large khan or shed where merchandize is lodged; some Greek Christians continually refiding here, Mahometan ecclesiastics, and others; and a number of fishermen and people more immediately connected with the sea. The population, however, is restrained by the difficulty of procuring water, scarcity of provisions, and other inconveniences, but invariably much exceeding the estimate given by Volney and others. Suez, according to Browne, is very modern, having been probably built within the last 300 years: and it is unknown to travellers of a more ancient date. At Suez, the chief article of trade is coffee. The sea here produces few fish: eels, indeed, and a few others of the shell kind, are seen; but the best fish come no higher than Coloph. Meat is scarce, bread of an inferior quality, and sometimes hardly eatable. Butter and milk are brought in small quantities by the Arabs. Water is brought from three several places: Bir-Naba, northward, affords the best; the other places are Aide-Mulga, and Bir-es-Suez. It is always bought in the skins at a considerable price; and in case of a war with the Arabs, none could be had.

Formerly the districts in the vicinity of Suez, says Volney, were covered with towns, which have disappeared with the waters of the Nile; the canals, which conveyed their waters, are destroyed, for in this shifting soil they are presently filled up, both by the hands driven by the winds, and by the cavalry of the Bedouin Arabs. At present, the commerce of Cairo with Suez is only carried on by means of caravans, which wait the arrival, and set out on the departure of the vessels, that is, towards the end of April, or the beginning of May, and in the course of the months of July and August. That which Volney accompanied in 1783, consisted of about 3000 camels, and 5000 or 6000 men. The merchandise consisted in wood, furs, and cordage for the ships at Suez; in some anchors, carried each of them by four camels, iron bars, carded wool, and lead; it likewise carried bales of cloth, and bundles of cochineal, corn, barley, and beans, Turkish paitres, Venetian sequins, and Imperial dollars. All these commodities were destined for Djededa, Mecca, and Moka, where they were to be bartered for Indian goods, and the coffee of Arabia, which forms the principal article of the return. There was besides a great number of pilgrims, who preferred the voyage by sea to a land journey; and it also carried the necessary provisions, such as rice, meat, wood, and even water, for no place in the world is more deftute of every necessary than Suez. From the tops of the hills, any eye, surveying the sandy plain to the N.W., the white rocks of Arabia to the E. or the sea, and the mountain Mokattam to the S., cannot discern even a sedge tree, or the smallest spot of verdure. Suez presents no prospect but extensive yellow sands, or a lake of green water; the ruinous condition of the houses heightens this melancholy scenery. The only water which can be drunk is brought from El-Naba, or the spring, situated at the distance of three hours journey on the Arabian shore; but it is so brackish that without a thorough distillation, it is impotable to Europeans. The sea might furnish a quantity of shell and other fish; but the Arabs seldom attempt fishing, at which they are far from expert; when the vessels are gone, therefore, nobody remains at Suez but the governor, who is a Mamlouk, and twelve or fourteen persons, who form his household, and the garrison.

The fortres is a defenceless heap of ruins, which the Arabs consider as a citadel, because it contains six brahs four-
four-pounders, and two Greek gunners, who turn their heads aside when they fire. The harbour is a wretched quay, where the smallest boats are unable to reach the shore, except at the height of the Red sea. There, however, the merchandize is embarked to convey it over the banks of fand, to the vessels which anchor in the road. This road, situated a league from the town, is separated from it by a shore, which is left dry at low water; it has no works for its defence, so that the vessels, which have been seen there to the number of 28 at a time, might be attacked without opposition, for the ships themselves are incapable of resistance, none having any other artillery than four rusty swivels.

Their number diminishes every year, since by continually coaling along a shore full of fand, one out of nine, at least, is shipwrecked. In 1783, one of them having anchored at El-Tor, to take in water, was surprized by the Arabs, while the crew were sleeping on shore. After plundering it of 1500 bags of coffee, they abandoned the vessel to the wind, which threw it on the coast. The dock at Suez is ill adapted to repair such damages; scarcely do they build a casaille in three years. Befides that the sea, which, from its flux and reflux, accumulates the sand upon that coast, will at last choak up the entrance, and the fame change will take place at Suez, which has already occurred at Kolzoum and Arfinne. Suez is 60 miles E.S.E. distant from Cairo. N. lat. 30°. E. long. 33°25'. Volney. Niebuhr. Browne.

**Suez, Jíbmu of.** that narrow neck of land which separates the Red sea from the Mediterranean. It has been a question much agitated in Europe, whether it would be practicable to cut through this Jíbmu, so that vessels might arrive at India by a shorter route than by the Cape of Good Hope. This space is not more than 16 or 19 ordinary leagues; nor is this interval interfected by mountains; nor can we discover, from the tops of the terraces at Suez, with any telescopes, a single obstacle on the nacked and barren plain to the N.W.; and hence may be inferred, that it is not the difference of levels which prevents the junction. Some, indeed, among the ancients were of opinion, that the Red sea was higher than the Mediterranean; and in fact, if we observe, that from the canal of Kolzoum to the sea, the Nile has a declivity, for the space of 30 leagues, this idea will not appear so ridiculous. The great difficulty of accomplishing this object arises from the nature of the corresponding coasts of the Mediterranean and Red sea, which are covered with shrubs, thorns and sandy soil, where the waters form lakes, fand, and morasses, so that vessels cannot approach within a considerable distance. It will therefore be found scarcely possible to dig a permanent canal among these shifting sands; not to mention that the shore is defile of harbours, which must be entirely the work of art. The country, besides, has not a drop of fresh water, and to supply the inhabitants, it must be brought as far as from the Nile.

The best and only method, therefore, of effecting this junction, is that which has been already successfully practiced at different times; which is by making the river itself the medium of communication, for which the ground is perfectly well calculated; for mount Mokattam suddenly terminating in the latitude of Cairo, forms only a low and semicircular mound, round which is a continued plain from the banks of the Nile, as far as the point of the Red sea. The ancients, who early understood the advantage to be derived from this situation, adopted the idea of joining the two seas by a canal connected with the river. Strabo (lib. xviii.) observes, that this first was executed under Seleucus, who reigned about the time of the Trojan war; and this work was so considerable as to occasion it to be remarked, "that it was 100 cubits (or 170 feet) wide, and deep enough for large vessels." After the Greeks conquered the country, it was restored by the Ptolemies, and again renewed by Trajan. In short, even the Arabs themselves followed these examples. "In the time of Omar-ebn-el-Katbar," says the historian El Makin, "the cities of Mecca and Medina suffering from famine, the caliph ordered Amrou, governor of Egypt, to cut a canal from the Nile to Kolzoum, that the contributions of corn and barley, appointed for Arabia, might be conveyed that way."

This canal is the same which runs at present to Cairo, and is used itself in the way to the N.E. of Berket-el-Hadji, or the Lake of the Pilgrims. Volney.

**SUFANGH ul Babri, a narrow island in the Red sea, near the coast of Egypt, about 7 miles in length. N. lat. 27°. E. long. 33°56'.**

**SUFEEDOON, a town of Hindooftan, in the subah of Delhi; 60 miles W. of Paniput.**

**SUFFA, a town of Candahar; 30 miles E.N.E. of Candahar. N. lat. 33° 10'. E. long. 66° 0'.**

**SUFFERANCE, in Ancient Customs, a delay or respite of time, which the lord granted his vassal, for the performance of fealty and homage, so as to secure him from any feudal feiseur.**

Sufferance, say the customs, is equivalent to fealty and homage, while it holds.

The word is also used for a delay which the lord grants his vassal, to quit themselves of fees or inheritances they have acquired, till they have paid the due of indemnity, &c.

**SUFFERANCE, Bill of. See BILL.**

**SUFFERANCE, EJFate au, in Lawo, is where one comes into possession of land by lawful title, but keeps it afterwards without any title at all. As if a man takes a lease for a year, and after the year is expired, continues to hold the premises without any fresh leave from the owner of the eftate. Or, if a man maketh a lease at will and dies, the eftate at will is thereby determined; but if the tenant continues possession, he is tenant at sufferance. This eftate, in the case of a subjek, may be destroyed, whenever the true owner shall make an actual entry on the land and oust the tenant; for, before entry, he cannot maintain an action of trespass against the tenant by sufferance, as he might against a stranger; because the tenant being once in by a lawful title, the law will suppose him to continue upon a title equally lawful; unless the owner of the land, by some public and avowed act, such as entry, will declare his continuance to be tortious or wrongful. Thus stands the law, with regard to tenant by sufferance; and landlors are obliged in those cases to make formal entries upon their lands, and recover possession by the legal processes of ejectment; and at the utmost by the common law, the tenant was bound to account for the profits of the land by him detained; but now by 4 Geo. II. c. 28. in case any tenant for life or years, or other person claiming under, or by collusion with such tenant, shall wilfully hold over after the determination of the term, and demand made in writing for recovering the possession of the premises, by him to whom the remainder or reversion of them shall belong; such person, if holding over, shall pay, for the time he continues, at the rate of double the yearly value of the lands so detained. This has also put an end to the practice of tenure by sufferance, unless with the tacit consent of the owner of the tenure. Bl. Com. vol. ii. See EJECTIONE Firma.**
SUFFERDA M, SUFFERDON, in Geography, a small fishing town of Hindoostan, on the coast of Concan; 15 miles S. of Choule.

SUFFETES. See Carthaginians.

SUFFIA, in Geography, a town of Bengal; 14 miles N.W. of Calcutta.

SUFFIBULUM, among the Romans a name given to the pretexta of the pontiffs, and palas of the Vestal virgins.

SUFFIELD, in Geography, a pleasant post-town of America, in Hartford county, Connecticut, with a handsome church and some respectable dwelling-houses, containing 2680 inhabitants. It lies on the W. bank of Connecticut river, on the great post-road from Boston to New York; 10 miles S. of Springfield.

SUFFEMENTA, Fumigation, in Pharmacy. See Perfumes.

SUFFINAGORE, in Geography, a town of Bengal; 14 miles N. of Ihalabad.

SUFFITION, Suffitto, among the Romans, a kind of Fration, practiced by persons who had attended a funeral; it was performed by walking over fire, and being sprinkled with water.

SUFFITUS, Suffiment, or Suffumigation, in Medicine, a thickish powder, prepared of odoriferous plants, gums, &c. which being thrown on coals, the vapours or fumes of them are received by smelling. See Perfumes.

SUFFOLATION, in Rural Economy, blown up with rich green food in different animals. See Blown and Hove.

SUFFOCATIO STRIUDA. See Croup.

SUFFOCATION, in Medicine, apoplexy, the destruction of life by impeding respiration.

The three ordinary modes of suffocation, or interruption of the breath, are hanging, drowning, or the respiration of fixed air, or carbonic acid gas. The fame result takes place from either of these causes, which is described at length under the article Drowning, and the same process is required for the resoration of breathing and animation in all these cases, except that, in the instance of suffocation by carbonic acid air, (whether arising from mines, lime-kilns, or vats of fermenting liquor,) the vital powers become more speedily and completely extinct, and the difficulty of resoration therefore greater. See Drowning.

SUFFOCATIVE CATARRH. See Catarrh.

SUFFOLK, in Geography, one of the maritime counties, or shires, on the eastern coast of England, is bounded by the German ocean on the east, by Essex on the south, from which it is divided by the river Stour; on the north by Norfolk, and on the west by Cambridgeshire. On Mr. Hodgkin's map of this county, may be measured an oblong of an almost unindented form, 47 miles long by 27 broad. This form comprehends a surface of about 812,160 acres, but Arthur Young is of opinion that the superficial contents of Suffolk do not exceed 800,000 acres.

General History.—Suffolk, so called from the Saxon appellation Sudulf, or southern people, in contradistinction to the Norulf, or northern people, constituted, at the time of the invasion of the Romans, part of the district belonging to the tribe whose conquerors determined Iceni, or Cenomani. In the Roman division of the island, it was comprehended in the province of Flavia Caerfensia. When the Romans, after a possession of four centuries, abandoned Britain, the Saxons, on the invitation of its puflanimous inhabitants, made themselves complete masters of the country, Suffolk constituted, with Norfolk and Cambridgeshire, one of the seven petty kingdoms (called East Anglia) into which these new masters parcelled out the island. To this state the German ocean formed a natural barrier on the east and north-east. The Stour divided it from the kingdom of the East Saxons, or Essex, on the south; and on the west and north-west it bordered upon the Mercian kingdom. The boundary on that side has not been accurately ascertained; but it is generally supposed that the infamous effort of human labour, known by the name of the Devil's Ditch, on Newmarket Heath, was formed as a line of demarcation and mutual defence. Abbot Floriciens fays, that "on the west part are a ditch and mound, like a lofty wall." By subsequent monastic writers it has been termed St. Edmund's ditch; and many antiquaries and historians have adopted this appellation.

When William the Conqueror had by his sword made good his claim to the English crown, the county of Suffolk was divided among his principal officers, in the following manner.

To Hugh de Abrincis, earl of Chester, his sister's son, he gave

To Robert, earl of Morton and Cornwall

To Odo of Champagne, earl of Albemarle and Holderness

To William Warren, earl of Surrey

To Eudo de Rye, reward of his household

To William Malet, lord of Eye in this county

To Robert de Todesc, a noble Norman

To Robert de Stafford

To Alberic de Vere, earl of Oxford

To Jeffery de Magniv, or Mandevil

To Richard de Tonebruge, or de Clare

To Roger Bigod, earl of Norfolk

To Ralph de Lim fiz

To Hugh de Grentmaisell

To Peter de Valoin

To Ralph Baineart

To Swene de Eslox

To Roger de Aubier

To Robert Bland, or Blunt

At the same time, Ralph Wafer, or Guader, was by the Conqueror constituted earl, or chief governor of the county, as well as Norfolk; but this nobleman, having conspired against the king, was obliged to quit the country, upon which his titles were conferred upon Roger Bigod.

About 1175, in the reign of Henry II., Suffolk was invaded, and its property greatly injured, by an army of Flemings, under the command of Robert, earl of Leicester. Meeting the royal troops at Burry, a battle ensued, and the former were repulsed with great slaughter. In the time of king John this county was again invaded, and subjugated by Louis, the dauphin of France, and his allies, the barons. During the reign of king Richard II. the populace of Suffolk, headed by John Wraw and John Ball, two priests, committed great excesses here, and among other persons, put to death the earl of Suffolk, then lord chief justice of England.

Nearly the whole of Suffolk is under the government and within the jurisdiction of the see of Norwich; it is divided into two archdeaconries, Sudbury and Suffolk; and these again into twenty-two deaneries.

Property.—The estate of property in this county may be considered beneficial in its division. The largest estate is supposed not to exceed 8500l. a year; there are three or four others which rise above 5000l., and about thirty others,
SUFFOLK.

Others, of 3000l. and upwards. Below this standard there are many of all sizes; but a circumstance which strongly indicates the prosperity of this portion of the kingdom, is the great number of yeomen, or farmers occupying their own lands, of a value rising from 100l. to 400l. a year. These, as Mr. Young emphatically remarks, are "a most valuable set of men, who having the means, and the most powerful inducements to good husbandry, carry agriculture to a high degree of perfection." The farms in Suffolk must, in a general light, be reckoned large; and to this circumstance chiefly may be attributed the good husbandry so generally found in the county. In the district of strong wet loam there are many small farms, from 20l. to 100l. a year; but these are intermixed with others, rising from 150l. to 300l. and even higher. In the sandy district they are much larger, from 300l. to 800l. or 900l. The usual terms for leases are seven, fourteen, and twenty-one years. Few counties have been more improved by the latter than Suffolk. By means of such leases, whole tracts in the sandy districts have been converted from warren and sheep-walks into productive enclosures. They have caused large tracts to be levelled; and occasioned an improved cultivation in almost every respect, which depended on the expenditure of larger sums than are laid out by farmers unable or unwilling to make such exertions.

Mr. Young gives the following estimate of the total rental of the county, founded upon the division of it according to the soil.

<table>
<thead>
<tr>
<th>Acres</th>
<th>£</th>
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<tbody>
<tr>
<td>30,000</td>
<td>6,000</td>
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<tr>
<td>46,666</td>
<td>45,000</td>
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<tr>
<td>156,666</td>
<td>99,999</td>
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<tr>
<td>115,333</td>
<td>33,999</td>
</tr>
<tr>
<td>453,333</td>
<td>325,666</td>
</tr>
<tr>
<td>800,000</td>
<td>538,664</td>
</tr>
</tbody>
</table>

Buildings.—On a survey of the buildings in general of this county, the neglect of elegance and convenience in those of gentlemen of a certain property, as well as in farm-houses, cannot fail to strike the observer. The latter, indeed, are much improved within the last twenty or thirty years, but even at present they are too often built of lath and plaster, which decays in a short time, cause repairs to be so heavy a deduction from the receipts of an estate. The extent to which this evil operates in the eastern part of the kingdom is scarcely credible. Mr. Young informs us, that on one estate of about 1300l. a year, the repairs amounted in eleven years to above 4000l.

Though some individuals have most laudably distinguished themselves by building neat and comfortable cottages for the labouring poor, the small profit which the rent affords has prevented this practice from being frequent. The cottages of Suffolk in general are bad habitations, deficient in contrivance for warmth and convenience, the state of repair bad, and the want of gardens too common. The general rent of them is from two to three pounds, with or without a small garden.

Commerce and Manufactures.—The commerce and manufactures of Suffolk are incumbered; and those are, from various causes, upon the decline. The imports are the same as in all the other maritime counties; and corn and malt are the principal exports. Lowestoft is celebrated for its having a fishery, which was formerly more productive than at present. The principal employment of the poor of the county was, till lately, the spinning and combing of wool, which extended throughout the greater part of Suffolk, with the exception of the district in which the manufacture of hemp is exclusively carried on. In the year 1784, the woollen fabric was estimated by Mr. Oakes, of Bury, to employ 37,000 men, women, and children, whose earnings amounted, upon an average, to 150,000l. per annum. The Norwich manufacture alone employed nearly half of the above number. At present this fabric is far from being so flourishing in this county, having been chiefly transferred to Suffolk. At Sudbury there is a manufacture of fustian, and also a small silk manufacturing; and some calicoes are still made at Lavenham.

Agriculture.—The farmers of Suffolk have, for some years past, emulated the more celebrated agriculturalists of Norfolk. Among the implements peculiar to, or invented and first employed in the county, may be reckoned the Suffolk plow-plough; the horse-rake, for clearing of springcorn stubbles; the new drill-plough, invented by Mr. Henry Balding, of Mendham, who was ten years in bringing it to perfection; the → a considerable expense; threshing-mills, on the improved construction of Mr. Abbey of Blithborough; and the extirpator, or scalp-plough, a machine for destroying weeds, and clearing ploughed lands for seed, invented by Mr. Hayward, of Stoke-Att. A gentleman of this county has also contrived a moveable stage for building the upper parts of stacks of hay or corn, and which may be equally well applied to other useful purposes.

The agricultural societies, which in other parts of the kingdom have been productive of great and extensive benefits, Suffolk is perhaps less indebted than any other county: the only institution of the kind is the Mellford Society.

Suffolk was formerly noted for its hop-grounds, but not more than 200 acres, in the neighbourhood of Stow, are now appropriated to this plant. Bullein, in his "Bulwark of Defence," and in his "Government of Heath," speaks particularly of the hops of this county; and Tufford, in his "Five Hundred Points of good Husbandry," gives directions about the management of this crop in Suffolk. Carrots, cabbages, and saffron, are all cultivated in different parts of the county. Arthur Young states that at least 240,000 sheep were usually fed within Suffolk.

Suffolk is not less celebrated for its breed of horses, than for its cows: they are often fed on carrots, and are never permitted to remain in the stable at night, being turned out into a yard well littered with straw, and supplied with plenty of good sweet oat or barley straw to eat, but never clover or hay. With this treatment a horse never has swelled legs, and seldom any other ailment; he is kept in as fine condition, and will hold his work several years longer than one confined in the stable. With poultry this county is extremely well supplied, and especially with turkeys, for which it is almost as celebrated as Norfolk. Great quantities of pigeons are reared in the numerous pigeon-houses, in the open field part of the county bordering on Cambridgeshire. Suffolk contains many rabbit-warrens, especially in the western sandy district. One of them, near Brandon, is estimated to return above 40,000 rabbits in a year. Of late years, however, considerable tracts occupied by them have been ploughed up and converted into arable and pasture land. The quantity of butter computed to be sent from Suffolk to London annually, is about 40,000 firkins.

Wheat.—Though Suffolk must be reckoned among the earliest inclosed of the English counties, yet Mr. Young calculates the wafers to amount to nearly 100,000 acres, or an eighth of the whole, comprehended under the term sheep-walk, common, warren, &c. "None of these," adds 3 M
SUFFOLK.

that writer, "are, briefly speaking, absolutely wafte, if by that term is understood land yielding nothing. I include all lands uncultivated, which would admit of a very great improvement, not always profitable to the tenant, who may, on a small capital, make a great interest per cent. by a warren, for instance, but in every case to the public. Many farmers think sheep-walks necessary for their flocks, which is very questionable. They are undoubtedly useful, and if they are converted into inclosures, the number of flocks kept would on a farm might in a few cases decline, but good grazings adapted to the soil would be abundantly more productive for the flock. Whoever has viewed the immense waftes that fill almost the whole country from Newmarket to Thetford, and to Gaffrop Gate, and which are found between Woodbridge and Orford, and thence one way to Saxmundham, not to mention the numerous heaths that are scattered everywhere, must be convinced that their improvements for grazings would enable the county to carry many thousands of sheep more than it does at present."

Plains of the Poor.--The amount of money levied in this county in 1802, for the maintenance of the poor, was 149,646l. being at the rate of 4s. 10½d. in the pound, on the annual rental. The most singular circumstance relating to the poor in Suffolk, is the incorporation of various hundreds for erecting and supporting houses of industry. The local inconvenience and diffi culties arising from the number of poor, and the expense of maintaining them, occasioned many districts in the county to apply to parliament for the power of incorporating themselves, and of regulating the employment and maintenance of the poor, by certain rules not authorized by the existing poor laws. Several acts of parliament accordingly passed, incorporating those districts where the poor have since been governed and supported according to the power given by such acts. The result of an actual examination of these institutions by T. Ruggles, esq. is given by Mr. Young in the following terms.

"In the incorporated hundreds, the houses of industry strike one in a different light from the cottages of the poor. They are all built in as dry, healthy, and plesant situations as the nature of the country will admit. The offices, such as the kitchen, brew-houfe, bake-houfe, buttery, laundry, larder, cellars, are all large, convenient, and kept extremely neat; the work-rooms are large and well aired, and theexces kept apart, both in hours of work and recreation. The dormitories are also large, airy, and conveniently disfopied; separate rooms for children of each sex, adults and aged. The married have each a separate apartment for themselves; mothers with nurfe children are also by themselves. The infirmaries are large, convenient, airy, and comfortable; none without fire-places. All the houses have a proper room for the necessaries of the poor, and most of them a surgeon's room besides. The halls are in all large, convenient, well ventilated, with two or more fire-places, and calculated, with respect to room, for the reception of full as many as the other conveniences of the house can contain.

"The chapels are all sufficiently large, neat, and plain, several of them rather tending to grandeur and elegance. There were two houses which had no chapels; one of them made use of a room ample enough for the congregation properly fitted up, and kept very neat; the other attended the parish church. The apartments for the governor were in all the houses large and conveniently disfopied. In one or two of these apartments were rather more spacious and elegant than necessary. There are also convenient store-houses and ware-houses for keeping the manufactures of the house, the raw materials, clothing, &c. for the use of the inhabitants.

"The land belonging to the houses, and the gardens in particular, are calculated for producing a sufficient quantity of vegetable diet, so necessary to the health, as well as agreeable to the palate of the inhabitants."

Soil.—Although the greater portion of the surface of this county be sand, yet in many places this is combined with different loams. Near the S.W. side of the county, on a line from Wratting, to North cove, near Beccles, a strong loam, on clay-marle, prevails. Almost the whole of the maritime district consists of a sandy loam, and this is most profitably and successfully cultivated. Nearly the whole of the north-western side of the county presents a dreary sterile scene, and merely affords a few patches of vegetation scattered amongst sand. Some sheep and rabbits however are fed in this district. Beneath the sand is a subfratrum of chalk. A small part of this county is sanny, and in some places the peat-bog is found from one foot to two feet beneath the surface. A tract called Burnt-fen has lately been so much improved by the reparation of banks, that 12,000 acres of land have been drained and cultivated.

Division and Population.—The two grand divisions of Suffolk are the franchise, or liberty of Bury St. Edmund's, and the body of the county, or iugulable land, each of which furnishes a distinct grand jury for the county affixes. These are subdivided into 21 hundreds, comprehending 532 parishes.

The inhabited houses in 1801 were 39,353
By how many families occupied 43,481
Uninhabited houses 552
Perfons 210,431
Chiefly employed in agriculture 55,744
In trade, manufactures, or handcraft 34,004
In all other occupations 115,632

Rivers.—Suffolk is a well-watered county; its boundaries to the south and north are rivers, navigable to a considerable extent, and it is every where intersected with streams, which, if the practice of irrigation were more generally adopted, would be productive of great benefit.

The Stour rises on the west side of the county, on the borders of Cambridge-Norfolk and forms throughout its whole course the boundary between Suffolk and Essex. It passes by Sudbury, and after being joined by the Bret, and other smaller streams, receives the tide at Manningtree. Here increasing considerably in breadth, it presents a beautiful object at high water, to the fine flat and grounds of Mityl Thorn. It meets the Orwell from Ipswich, and their united waters, having formed the port of Harwich, discharge themselves into the German ocean, between that town and Langford fort.

The Gipping has its source in the centre of the county, near Stow-Market. Running in a south-east direction, it waters Ipswich, and affimes below that town the name of the Orwell. The banks of this river are in general picturesque, especially when it becomes an estuary below Ipswich, to which place it is navigable for ships of considerable burthen.

The Deben, which has its source near Debenham, takes a south-eastern direction, and passing by Woodbridge, falls into the German ocean.

The Alde rises near Framlingham, and runs south-west to Wolborough, where having approached to within a very small distance of the sea, it suddenly takes a southerly direction, and discharges itself below Orford into the German ocean.

The Blythe has its source near Saxfold, in the hundred of Hoxne, whence running east-north-east to Halffworth,
it then proceeds almost due east to Blythburgh and Southwold, where it falls into the sea.

The Lark rises in the south-western part of the county, pales Bury and Mildenhall, and joins the Great Ouse not far from the latter town.

The Waveney and Little Ouse have already been mentioned under the article NORFOLK. The former, after running fifty miles towards the sea, in an eastern direction, and approaching its very shores, is opposed by a rising ground, which gives it an abrupt direction almost due north. This leads it to the river Yare; and though its waters are sufficient to give name to a harbour of its own, it merely affects as a secondary river in deepening and enlarging the harbour of Yarmouth. The meadows through which it passes with an easy and gentile course, are suppos'd to be among the richest in England.

Roads and Canals.—The roads in every part of this county are excellent, the improvements made in them of late years being almost inconceivable; in most directions, indeed, the traveller finds crofs ones equal to turnpike roads.


SUFFOLK, a county of Upper Canada, bounded E. by the county of Norfolk, S. by lake Erie, until it meets the carrying-place from Point aux Pias unto the Thames, W. by the carrying-place or portage, and thence up the river Thames, until it meets the north-westernmost boundary of the county of Norfolk. Its boundaries were established by proclamation, July the 6th 1804. In conjunction with Effex, to give name to a harbour of its own, it merely affords as a secondary river in deepening and enlarging the harbour of Yarmouth. The meadows through which it passes with an easy and gentle course are supposed to be among the richest in England.

SUFFOLK, a county of America, in the state of Massachusetts, deriving its name from that of England, in which governor Winthrop lived, before his emigration to America.

It contains two towns, viz. Boston and Chelsea, besides several islands, in which are 34,381 inhabitants. It was constituted a county May the 10th, 1643.

SUFFOLK, a county of New York, comprising all that part of Naffau or Long Island, that lies eastward of Queen's county; bounded N. by Long Island Sound, E. and S. by the Atlantic ocean, and W. by Queens county. The whole area may be about 598 square miles, or 510,720 acres. It contains 21,113 inhabitants, of whom 413 are slaves, 2335 electors and sends three members to the house of assembly. This county was settled at an early period of the American history; and a considerable part of its first inhabitants came from New England. The inhabitants of this county are distinguished by their sobriety, temperance, and industry; and it is said that more domestic happiness and plain republican truth are not found anywhere than among the inhabitants of Long Island; which is.

SUFFOLK, a port-town of Virginia, in Nancemond county, on the E. side of the river Nancemond, containing a court-house, gaol, and about 40 houses. The river is navigable as far as this town for vessels of 250 tons, 28 miles W. by S. from Portsmouth. Allo, a port-town of Virginia, in Sussex county; 185 miles from Washington.

SUFFOLK Bay, or Tscrnaka Bay, a bay on the W. coast of St. Vincent; 1 mile N. of Cumberton bay.

SUFFOLK Farmer's Cott., in Agriculture; a convenient and useful sort of cart for farm purposes, which has lately been introduced from that county into Suffolk with great benefit and advantage.

SUFFOLK Grass, the common name given to the dwarf meadow-grass, which is said to be very commonly met with on all good loamy lands, and to be perhaps the best grass which we have for pastures, from the rapidity with which it propagates itself, and the fondness which cattle have for it. It is well known to be a very troublesome weed in garden grounds. See GRASS, and POA ANNUA.

SUFFOLK Powder, the name of a medicinal powder, good for the bite of a mad dog. It had its name from a country of Suffolk, who used to give it with great successe. It is still kept as a secret in some private families, but seems to be only the flavr of the earth, or the common buckthorn plantain dried and powdered, or the powder with some very trifling addition. This plant has been famous for its virtues in this case a great while among us, and Dr Grey, in his Complete Farrier, gives the method by which he cured dogs by it with great success. See Phil. Trans. No 450. p. 455.

SUFFRAGAN, suffraganus, in the Ecclesiastical Policy, a term applied (but not very properly) to a bishop, with respect to his archbishop, on whom he depends, and to whom appeals lie from the bishop's official.

In this sense, the archbishop of Canterbury has twenty-one suffragans, and the archbishop of York four. The term was never heard of before the eighth century. Some derive it hence, that the bishops are to help and assist the archbishop; quia archiepiscopus suffragani et subjectus tenuatur. Others say, it is because ecclesiastical matters are determined by their votes, or suffrages; et suffragium dicitur, quia cum suffragat causa ecclesiastica judecantur. Others hold they are called suffragans, because when called by a metropolitans to a synod, they have a right of suffrages, or of voting, or because they could not be consecrated without his suffrage.

Suffragan is more properly used for a choripcopos, or an assistant bishop, or coadjutor, who has a title in paribus sequilum, and assists another in the discharge of his function, or discharges itself in the absence of that other. They were consecrated, like other bishops, by the archbishop of the province, and appointed as titular bishops, to execute such power and authority, and to receive such profits as were limited in their commissions by the bishops or diocesan, whose suffragans they were, and whom they affiliated in duties merely episcopal; they conforming to orders, confirmation, and consecration of divers kinds. And in this respect, it is said, they differed from the coadjutors who affiliated their bishops in matters chiefly of jurisdiction, as in collating to benefices, granting institutions, dispensations, and the like, and who for these purposes need not have been episcopally ordained. This was the practice here in England especially: the two ends of orders, and of jurisdiction voluntary, in case of the inability of a bishop, were answer'd by two different persons; the first under the name of suffragan, and the second under that of coadjutor.

The suffragans are thus signified to be called episcopal bishops, by statute 26 Henry VIII. cap. 14. every archbishop or bishop, dispobed to have any suffragan, is allowed to name two proper persons, and to present them to the king, who was empowered to give one of them the title, style, and dignity of bishop and such of the fees as are mentioned in the statute, as he thought fit; and every such person should be called bishop suffragan of the same fee, and be consecrated accordingly. This act specifies the places for which such suffragans were to be appointed, and fixes the place of their respective residences. Their profits and jurisdiction were to be limited by the commission of the archbishop or bishop to whom they were suffragans, and the time of the exercise of their office was also limited by the same com-
mony: and they were forbord to exercise it otherwise than such communion directed, on pain of a premontré. Suffragans have now been discontinued for many years.

Du Cange observes, that the title suffragan has also been given to such priests as are subject to the visitation of the archdeacon; and suffragan of the pope, to the bishops of such dioceses as are immediately subject to the pope.

SUFFRAGE, SUFFRAGIUM, a voice or vote given in an assembly where something is deliberated on, or where a person is elected to an office or benefice.

The word is formed from the Latin, suffragium, which anciently signified money, as appears in the eighth novel of Juvenal: ut iudices sine suffragio sint; and the sixth novel, qui emerit presulatum per suffragium, episcopatus & ordine ecclesiasticus excitat.

Suffrages are sometimes given by word of mouth; and sometimes in writing, as at elections liable to a scrutiny. The president or chairman of the assembly usually collects the suffrages.

SUFFRAGES OF THE SAINTS, in the Remill Church, denote the prayers and intercessions which the saints are supposed to make to God in behalf of the faithful.

SUFFRAGE, in Geography, a name formerly given to a township of Ottego county, in New York, on the N. side of the Susquehanna, taken from Undalla, and incorporated in 1706; but its name has been since changed.

SUFFREIN'S BAY, a bay on the E. coast of Chineee Territory, so called by Perouze. N. lat. 47° 51'. E. long. 158° 47'.

SUFFERTRICUS PLANTS, in Gardening, a term applied to those sorts of luscious or somewhat woody vegetables, that are of a nature, in some degree, between that of the shrubby and the herbaceous, as exemplified in thyme, fage, hyssop, winter-favorvy, and many other such plants. The term properly signifies under-shrubby, and is consequently applied to plants of that kind.

SUFFUMIGATION, SUFFUMIGATIO, from sub, under, and fumus, smoke, in Medicine, a term applied to all remedies that are received into the body in form of fumes, i.e. of smoke, vapour, or perfume.

Suffumigations are composed of different matters, according to the nature of the disease. Their intentions are to soften sharp serous humours, to provoke or check the course of the menses, to raise a saltation in venereal evils, &c. See FUMIGATION and FUMIGATOR.

SUFFUSIO, the name given by Celsus to a cataract, or opacity of the crystalline lens.

SUFFUSION, SUFFUSIO, an overflowing of some humour, shewing itself in the skin; particularly that of the blood or bile.

That redness ordinarily arising from shame, is only a suffusion of blood appearing in the cheeks. See BLUSHING.

The jaundice is a suffusion of bile over the whole body. See JUNDICE.

SUIF, the Eastern name for a sect of poets, corresponding nearly to the Mystics of the West. See SOPHIS, and MYSTICAL POETRY.

SUGAHILA, in Geography, a town of Africa, in the country of Sulmulme; 6 miles S.S.E. of Sulmulme.

SUGAR, SACCARUM, a very sweet, agreeable saline juice, expressed from a kind of canes, or reeds, growing in great plenty in the East and West Indies. (See SUGAR-CANE.) Pure sugar is perfectly transparent and colourless, when crystallized; but when granular, of a pure gross of white, soluble in water and alcohol, without smell, and with a faintly sweet taste, having no other flavour.

It is a question not yet decided among botanists, &c.

whether the ancients were acquainted with this cane, and whether they knew how to express the juice from the fame? What can we gather from the arguments advanced on either side is, that if they knew the cane, and juice, they did not know the art of condensing, hardening, and whitening it; and of consequence, they knew nothing of our fugar.

Some ancient authors, indeed, seem to mention fugar under the name of Indian salt; but they add, that it oozed out of the cane itself, and there hardened like a gum; and was even friable between the teeth, like our common salt; whereas sugar is expreseed by a machine on purpose, and congealed by the fire.

Theirs, Salmainus (Pliniani Exercit. tom. i. p. 716. G.) tells us, was cooling and loofening; whereas ours, the fame author affirms, is hot, and excites thirst. Hence some have imagined, that the ancient and modern fugar plants were different: but Matthiolus in Dioecorides, c. 75, makes no doubt they were the same; and others are even of opinion, that ours has a laxative virtue, as well as that of the ancients, and that it purges puitia.

The generality of authors, however, agree, that the ancient fugar was much better than the modern; as confitting of only the finest and maturest parts, which made themselves a passage, and were condensed in the air. The interpreters of Avicenna and Serapion call fugar, Nudium; the Persians, tabasir; and the Indians, mbam. Salmainus (Contra de Sacchar. apud Plin. Exercit. vol. ii. p. 257, A.D. 1650) affirms us that the Arabs have used the art of making fugar, such as we now have it, above nine hundred years.

Others produce the following verses of P. Terentius Varro Atacinus, to prove that it was known before Jesus Christ:

"Indica non magna nimis arbo re crecit arundo; Illius e lentis premittur radicibus humor, Dulcia cui nequeant succo contendere melia."

Dr. William Douglas, in his Summary, &c. of the first planting of our American settlements, printed at Boston in 1751, and reprinted at London in 1755, affirms, that sugar was not known among the ancient Greeks and Romans, who used only honey for sweetening. Paulus Epigenes, he says, a noted compiler of medical history, and one of the last Greek writers on that subject, about anno 1635, is the first who expressly mentions sugar: it was at first called Mel arundiscaccum, i.e. reed or cane honey. He adds that it came originally from China, by way of the East Indies and Arabia, into Europe, and was formerly used only in syrups, conerves, and such Arabian medicinal compositions.

Lucas, enumerating the eastern auxiliaries of Pompey, describes a people who used the cane-juice as a common drink.

"Qui bibunt tenerà dulces ab arundine succos."

Another question among the naturalists is, whether the sugar-canels be originally of the West Indies, or whether they have been translated rather from the East?

The learned of these late ages have been much divided on the point; but Dr. Labat, a Dominican missionary, in a dissertation published in 1722, affirms, that the sugar-cane is natural to America, as India; and that the Spaniards and Portuguese first learned from the Orientals the art of expressing its juice, boiling it, and reducing it into fugar.

Those who adopt this opinion assert, that the sugar-cane was
SUGAR.

was found growing spontaneously in many parts of the new hemisphere, when first explored by the Spanish invaders. In support of this opinion, Labat quotes, among other authorities, that of Thomas Gage, an Englishman, who went to New Spain in 1625, and who enumerates sugar-canes among the fruits and provisions with which the Charibes of Guadaloupe supplied the crew of his ship. Labat further adds, that, besides the evidence of Francis Ximenes, who, in a treatise on American plants, printed at Mexico, affirms that the sugar-cane grows without cultivation, and to an extraordinary size, on the banks of the river Plata, we are assured by Jean de Lery, a Protestant minister, who, was chaplain in 1559, on the Dutch garrison in the fort of Coligny, on the river Janeiro, that he himself found sugar-canes in great abundance in many places on the banks of that river, and in situations never visited by the Portuguese. Father Hennenep, and other voyagers, bear testimony, in like manner, to the growth of the cane near the mouth of the Mississippi; and Jean de Laet to its spontaneous production in the island of St. Vincent. Hence it is concluded, that it is not for the plant itself, but for the secret of making sugar from it, that the West Indians are indebted to the Spaniards and Portuguese; and these to the nations of the East. Thus reflects Labat, and the first editions of his book is of opinion that his reasoning is incontrovertible; and it is also greatly confirmed by recent discoveries; the sugar-cane having been found in many of the islands of the Pacific ocean, by our late illustrious navigator captain Cook. In these accounts, says Mr. B. Edwards, there is no contradiction. The sugar-cane might have grown spontaneously in many parts of the new world; and Columbus, unprudently, of the circumstances, might likewise have carried some of the plants to Hispaniola; and this most probably was the fact.

However, the settlers applied to its cultivation, affords a wonderful contrast to the manners of the present inhabitants; since it appears, by the testimony of Oviedo, that no less than 30 ingenios, or sugar-mills, were established on that island to early as the year 1555.

Other writers, however, have maintained, that it was not known in America till the Europeans transplanted it thither. Its origin appears to have been from the inland continent of Asia, very probably as far east as China, where it abounds. As it grows in all quarters of the globe, it was first transplanted to Cyprus, and thence (according to various authors) into Sicily, where considerable quantities of it were produced about the year 1748, and thence, as some have asserted, was brought from India by the Saracens. Laftau conjectures, that the plant itself was unknown in Chrifdom, until the time of the Crusades. Its cultivation, and the method of preparing and purifying the juice, as practiced by the inhabitants of Acra and Tripoli, are described by Albertus Aquensis, a monkish writer, who observes, that the Christian soldiers in the Holy Land frequently derived refreshment and support, in a scarcity of provisions, by sucking the canes. It flourished also in the Morea, and in the islands of Rhodes and Malta, and from thence was transplanted into Sicily, but the time is not precisely ascertained. Laftau recites a donation of William, the second king of Sicily, to the monastery of St. Bennet, of a mill for grinding sugar-canes, with all its rights, members, and appurtenances. This happened in 1166. From Sicily it was transplanted by the Portuguese to Madeira about the year 1445, and from Sicily, or the Southern coast of Africa, to Egypt, that Province, through the efforts of the Hibertus, obissar, from Granada, which derived it from Valencia, whence it might have been transplanted by the Arabian Moors, it was brought to the Canaries; from the Canary islands to Brazil; where, indeed, some suppose sugar was originally and spontaneously produced. Others are of opinion, that the Portuguese, before they discovered, or at least planted in Brazil, being in possession of the coast of Angola in Africa, first transplanted the sugar-cane from Angola to Brazil. About the year 1506, sugar-canes were brought from Brazil and the Canaries, and planted in the island of Hispaniola, where many sugar-mills were gradually erected. It appears, however, by the testimony of Peter Martyr, in the third book of his first Decad, written during Columbus's second expedition, which began in 1493 and ended in 1495, that the sugar-cane was at that period sufficiently known in Hispaniola. The fact seems to have been, that Columbus himself carried it thither, among other articles and productions which he conveyed from Old Spain, and the Canary islands, where it grew, in his second voyage. In 1641, sugar-canes were transplanted from Brazil to Barbadoes, and thence to our other West India isles; as from Brazil they were also carried to the Spanish West India isles, and also the Spanish dominions in Mexico, Peru, and Chili; and lastly, to the French, Dutch, and Danish colonies.

The boiling and baking of sugars, says Dr. Heylin, in his Catalogography, the first edition of which was printed in 1624, as it is now used, is not above two hundred years old; and the refining of it more new than that, first found out by a Venetian in the days of our forefathers, who got one hundred thousand crowns by the invention. Before which art of boiling and refining it, our ancients made use of it rough as it came from the canes, but they most commonly used honey instead of it. The first account we have of sugar-refiners in England is in the year 1659. Anderson's Hist. of Com. vol. i. p. 82. 246. 331. 334. vol. ii. P. 79. 105.

SUGAR-Cane, in Botany. See Saccharum.

The root of this plant is jointed like those of the other sorts of canes and reeds, from which arise four, five, or more shoots, according to the age or strength of the root; these grow from eight to ten or twenty feet high, according to the richness of the ground; but those of middling growth are the best.

The canes are also jointed, and the length as well as the size of the joints depend upon the weather and the soil; when the joints are placed leaves, the cane is said to be open-branched; if the leaf on the cane to the next joint above their inferior, before they expand. The first joint, which comes out either at the third, fourth, or fifth month, according to the season and soil, always keeps in its first place near the earth; out of this comes the second, and out of the second a third, &c. each week producing its joint, or very nearly, and a corresponding leaf likewise drying and falling off nearly every week.

A cane of thirty-two joints, which is fit to be cut, has from five to twenty-eight of them which have lost their leaves, the next five or six still have their leaves, in a withered state, and ready to fall off; and the remaining joints, surrounded with green leaves, form the head, which is cut off after the last leaf is withered. In a cane, whole length is from seven or nine feet, and which grows in a new, or a very moist and favourable soil, the number of useful joints is between forty and fifty, the first above the ground generally appearing at the end of three months, or, with frequent showers, a fortnight sooner; and many canes in such a foil are found rotten, or almost dried up, at the end of thirteen months; and the fruit was exposed, well drained, and worked for a number of years, canes not shorter than four feet and a half have thirty-eight or forty joints, the first joint
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joint appearing about the fourth or middle of the third
month, and many canes that have been cut in such a foil at
the end of fourteen or fifteen months being found rotted or
dried; in a dry, but good foil, not manured, but well
worked, and seconded by the season, the canes have been
from three to four feet long, and have had from thirty to
thirty-four joints; the first joint coming out at the end of
four or four months and a half; and canes of this kind have
been found standing at the end of fifteen months, but very
dry, and sometimes a little changed; in a foil which is still
dried, and more parched, canes which have been about two
feet high have had from twenty-four to twenty-eight joints,
the first of which appears at the end of the fifth month, and
many of these canes have been dried at the end of fifteen
months. From these and similar observations on the growth
of canes in various kinds of foil, it has been inferred, that
if there be any in which they can exit till the fifteenth or
sixteenth month, they never grow to any kind of purpose
in any after the thirteenth, or even after the twelfth.
A deep foil and light land are most suitable to the fugar-cane;
and the rainy season is the proper time for planting it: the
sooner they are planted after the rains begin to fall, the
more time they have to get strength before the dry weather
sets in.

If the ground is proper for the fugar-canes, and they are
planted at a good distance from each other, and the land is
carefully managed by changing the crops to other species,
or allowing a fallow to rest and recover itself, the cane
plantation, says Mr. Miller, may be continued above twenty
years without replanting, and produce good crops the whole
life; whereas, in the common method, they are generally
replanted in five or seven years, and in some of the poor land
they are continued but two or three years. The canes are
propagated by cuttings or joints of proper lengths, from
fifteen to twenty inches, in proportion to the nearness of the
joints; which are generally taken from the tops of the canes,
just below the leaves; but Mr. Miller says, that if
they were chosen from the lower part, where they are less
cullulent and better ripened, they would not produce canes
so luxuriant, but their juice would be less crude, and con-
tain a greater quantity of fuls, which would be obtained by
less boiling than that of the commonly planted. However,
Mr. Cazaud, a late writer, and a planter of fugar-
canes, observes, that the upper part, commonly called the
head, is the best part that can be used for propagating
them; and he recommends to put the plant in the ground
as soon as it is cut. The distance which the canes are
usually allowed in planting is from three to four feet, row
from row; and the hills are about two feet alder in the
rows, in each of which hills they plant from four to seven
or eight cuttings; instead of which number, productive
often of blights, Mr. Miller is of opinion, that if one good
cutting were planted in each hill, or two at most, and if
both succeeded, the weakest were drawn out soon after they
had taken, blights would be prevented, and the quantity of
sugar would be full as great, and require little more than a
fourth part of the fuel to boil it. In the proper season
for planting, the ground should be marked out by a line, that
the rows of canes may be straight and at equal distances;
and the whole should be divided into pieces of sixty or se-
venty feet broad, leaving intervals between each of about
twenty feet, for the convenience of passage, and for the ad-
million of the sun and air between the canes.

The common method of planting the canes now practiced,
is to make a trench with the hoe, which is performed by
the hand; into this a negro drops the number of cuttings
intended to be planted, which are planted by other negroes,
and the earth drawn about the hills with the hoe, all which
is performed by the hand; but if the right use of the
plough was introduced, the work would be both better and
cheaper performed. If, therefore, instead of a trench
drawn by the hoe, a deep furrow is made with a plough,
and the cuttings properly planted therein, the ground being
deeper tilled, will be more favorable to the growth of
the canes. If the ground is afterward to be kept clear by the horse-
hoe, the rows of canes should be five feet asunder, and the
hills be two feet and a half distant; and but one cane left in
each hill. After they have made some shoots, the foamer
the horse-hoe is used, the more they will thrive, by keep-
ing the weeds under, and well tilling the land.

When the canes are from seven to ten feet high, and of
proportional size, the skin smooth, dry, and brittle; if
they are heavy, their pith grey or inclinable to brown,
the juice sweet and glutinous; they are esteemed in per-
fecction.

Mr. Cazaud observes, that the withering and fall of a
leaf is the only and a sufficient criterion of the maturity
of the joint to which it adhered; and that the eight left joints
of two canes, which are cut the same day, have exactly
the same age and the same degree of ripeness, notwithstanding
one of the canes may be fifteen, and the other only ten
months old: to which purpose he adds, that each joint of
the cane of a fuposed growth of ten months, contained the
same quantity of fugar as that of a cane of the fuposed
growth of fifteen months.

The time for cutting them is usually after twelve or fif-
ten months growth, but this varies according to the foil
and the season. Those which are cut toward the end of the
dry season, before the rains begin to fall, produce better
sugar than those cut in the rainy season, when they are
more replete with watery juice, and require a greater ex-
pense of fuel to boil it.

In those plantations where the number of negroes is
small, sugar is made in almost all feasons indifferently, and
consequently the canes are planted when the planter is best
prepared for his work, rather than at the most advantageous
time. The fystem of cultivation among planters, who are
better supplied in respect of labourers, consists in planting a
fourth or a fifth of their land in October, November, and
December; in digging very deep trenches, for the greater
nourishment of the root; in planting at great distances,
for the benefit of a freer circulation of the air; and in cutting
the canes in the four feint months, viz. February, March,
April, and May, because the sugar is then the finest, the
canes are cut with the leaf tops, and supply (as is fup-
posed) greater quantities of it. Those who adopt this
method, cut about three-fourths of their plantations, the
remaining being made up of young canes, to be cut the fol-
lowing year, and for new plants.

Mr. Cazaud, who has made many judicious observations
and experiments on the cultivation of the fugar-cane, has
adopted a new method. He employs the whole of the first
six months of the year in the buñilea of the crop, and in
May and June plants the canes which have been cut in
January. This course induces a necessity of cutting the
rattoons (or the canes proceeding from the old stumps) at
the end of the eleventh instead of the end of the twelfth
month, and the planted canes, which should stand fifteen
months, at the end of the year; so that the whole plant-
tation is cut every year; and he only plants a sixth part
of his land every year. He has largely illustrated the reasons
and advantages of this method; the fundamental principle
of which is the necessity of planting the canes in the only
season...
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season fitted to accelerate and preserve them: as in the Windward islands, the weather is commonly dry from the 15th of February to the 15th of May, and the rains are moderate till August, and copious the two or three following months, and afterwards decrease till February: and, therefore, the progression of the rain keeps pace, as it were, with that of the canes, when they are planted in May. With regard to the maturity of the cane, as far as it is of consequence to the sugar, this, he says, does not depend on the soil but on the season. In February, March, and April, all the canes, whatever be their age, are ripe as the nature of the soil ever allows them to be; and accordingly he never fails to make the greatest part of his sugar at this season. He observes, that the dryness of the weather, and not the age of the canes, which increases from January to April, is the cause, that in January four hundred gallons of juice commonly yield forty-eight gallons of sugar and molasses one with another; in February, from fifty to sixty; in March, from sixty to seventy-two; in April, sometimes eighty; after which period the sugar decreases, and when the rain is not very heavy, is at his business. The greatest relative maturity of his canes, he infers to be, when the juice of them was made up of four parts water, and one part of sugar and molasses; and in canes perfectly ripe, the quantity of sugar, he says, is equal to that of the molasses. After a trial of this plan for five years, he is convinced that there is a difference of above one-sixth in its favour. Miller's Gard. Dict. Phil. Trans. vol. i. part 1. art. xix. p. 207, &c.

The best soil, according to Mr. Edwards, which he has seen or heard of, for the production of sugar of the finest quality, and in the largest proportion, is the alluvial soil of St. Christopher's. Next to that is the soil, which in Jamaica is called the brick-mould, containing a due mixture of clay and sand. Plant-canes in this soil (which are those of the first growth) have been known, in very fine seaforns, to yield two tons and a half of sugar per acre. After this may be reckoned the black mould of several varieties. The beet is the deep black earth of Barbadoes, Antigua, and some other of the Windward islands; but there is a species of this mould in Jamaica, that is little if at all inferior to it, which abounds with lime and flint, on a substratum of foamy marl. We shall not enumerate the varieties of soil proper for this kind of culture; but content ourselves with mentioning a peculiar sort of land on the north side of Jamaica, chiefly in the parish of Trelawny, as few soils produce finer sugars, or such as answer so well in the pan, or which yield a greater return of refined sugar. This land is of a red colour, varying by different shades; but where every remarkable, when first turned up, for a glossy or shining surface, and, if wetted, for flaming the fingers like paint. This soil seems to consist of a native earth, or pure loam, with a mixture of clay and sand. It is easily wrought, and at the same time so tenacious, that a poasd dug in this soil in a proper situation, with no other bottom than its own natural texture, holds water like the finest clay. The system of husbandry in sugar plantations, which abound with this, chiefly depends on what are called root cane.

In most parts of the West Indies, it is usual to hole and plant a certain proportion of the cane-land (commonly one-third), in annual succession; and even the root of this land, on an average, is seven hopheads of 16 cwt. to ten acres, which are cut annually. In the cultivation of other lands, especially in Jamaica, the plough has been introduced of late years, and in some few cases to great advantage; but the use of the plough is not adapted to every soil or situation. The only advantageous system of ploughing in the Windward islands is to confine it to the simple operation of boling, which is much more easily and expeditiously performed by the plough than by the hoe, and which affords, in the case of stiff and dry soils, great relief to the negroes. The method of boling has been described. The proper season, generally speaking, for planting, is in the interval between August and the beginning of November. By having the advantage of the autumnal season, the young cane become sufficiently rooted before the severe dry weather sets in; thus the roots are kept cool, and the earth moist. By these means, they are ripe for the mill in the beginning of the second year, so as to enable the overseer or manager to finish his crop by the latter end of May. It has been justly remarked, that there is not a greater error in the system of plantings, than to make fugar, or plant canes, in improper seasons of the year; for by mismanagement of this kind, every succeding crop is put out of regular order. However, neither prudence in the management, nor favourable soils, nor seasonable weather, will secure the planter at all times from misfortune in the culture of his fugar canes. They are subject to a disease called the "blatt," which consists of many myriads of little insects of the aphus genus, said to be invisible to the unaided eye, whose proper food is the juice of the canes; in pursuit of which they wound the tender blades, and destroy the veins. The circulation is thus impeded, and the growth of the plant is checked, until it withers or dies in proportion to the degree of the ravage. In some of the Windward islands, the cane in dry weather is liable to be destroyed by a species of grub, called the "bovor." As Tobacco they have another destructive insect, called the "jump-fly." It is said that the "blatt" never attacks those plantations, where colonies have been introduced of the little animal, called the carnivorous ant; the "forina omnivora" of Linnaeus, and the "Raffles" ant of Jamaica.

The manure generally used in fugar-planting is a compound formed of the coal and vegetable ashes, drawn from the fires of the boiling and still-houses; feculences discharged from the still-houses, mixed with refuse of buildings, white lime, &c.; refuse, or field-trash, i.e. the decayed leaves and refuse of the canes, so called in opposition to the culture of his fugar canes. They are subject to a disease called the "blatt," which consists of many myriads of little insects of the aphus genus, said to be invisible to the unaided eye, whose proper food is the juice of the canes; in pursuit of which they wound the tender blades, and destroy the veins. The circulation is thus impeded, and the growth of the plant is checked, until it withers or dies in proportion to the degree of the ravage. In some of the Windward islands, the cane in dry weather is liable to be destroyed by a species of grub, called the "bovor." As Tobacco they have another destructive insect, called the "jump-fly." It is said that the "blatt" never attacks those plantations, where colonies have been introduced of the little animal, called the carnivorous ant; the "forina omnivora" of Linnaeus, and the "Raffles" ant of Jamaica.

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When the rattoons or canes are ripe, as they ordinarily are in twelve or fifteen months, or, as Mr. Cazanu apprehends, in eleven or twelve months, they are cut, and carried in bundles to the mills. The mills consist of three wooden rollers, covered with steel or iron plates; and have their motion either from the water, the wind, cattle, or even the hands of slaves. These rollers or cylinders are from 30 to 40 inches in length, and from 20 to 35 inches in diameter; and the middle one, to which the moving power is applied, turns the other two by means of cogs. Between these rollers the canes, being previously cut, are twice compressed; for having paffed the firrt and second rollers, they are turned round the middle one by a circular piece of frame-work, or scree, called in Jamaica the "dumb-returner," and are forced back through the second and third; an operation which squeezes them completely dry, and sometimes even reduces them to powder. (For a farther account of sugar-mills, see the sequel of this article.) The juice from the mill ordinarily contains eight parts of pure water, one part of sugar, and one part made of gros oil and mucilaginous gum, with a portion of effusional oil. Some juice, however, has been so rich
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as to make a hoghead (16 cwt.) of sugar from 1300 gallons; and some so watery as to require more than double that quantity. A pound of sugar from a gallon of raw liquor is reckoned, in Jamaica, very good yielding.

SUGAR. Preparation of. The juice or liquor runs from the receiver to the boiling-house, along a wooden gutter lined with lead. In the boiling-house it is received (according to the modern improved system, which almost universally prevails in Jamaica) into one of the copper pans or cauldrons, called clarifiers. Of these, there are commonly three; and their dimensions are generally determined by the power of supplying them with liquor. There are water-mills that will grind, with great ease, canes sufficient for thirty hogheads of sugar in a week. On plantations thus happily provided, the means of quick boiling are indifferently requisite, or the cane-liquor will unavoidably become tainted before it can be exposed to the fire. The purest cane-juice will not remain twenty minutes in the receiver without fermenting. As cane-juice is so very liable to fermentation, it is necessary also that the canes should be ground as soon as possible after they are cut, and great care taken to keep and throw aside those which are tainted, which may afterwards be ground for the still-house. Clarifiers, therefore, are sometimes seen of one thousand gallons each. On elates that make on a medium, during crop-time, from fifteen to twenty hogheads of sugar a week, there are clarifiers of three or four hundred gallons each are sufficient. With pans of this size, the liquor, when clarified, may be drawn off at once; and there is leisure to cleanse the vessels every time they are used. Each clarifier is provided either with a fision or cock for drawing off the liquor. It has a flat bottom, and is hung to a separate fire, each chimney having an iron slider, which being shut, the fire goes out for want of air. These circumstances are indispensible, and the advantages of them will presently be shewn. The clarifiers are commonly placed in the middle or at one end of the boiling-house. If at one end, the boiler called the "teafire" is placed next the other, and several boilers (generally three) are ranged between them. The teafe is ordinarily from 70 to 100 gallons, and the boilers between the clarifiers and teafe is filled with the next the top of the boiling-house. On very large elates, this arrangement is found useful and necessary. The objection to so great a number is the expense of fuel; to obviate which, in some degrees, the three boilers on each side of the clarifiers are commonly hung to one fire.

The fire then from the receiver having filled the clarifier with fresh liquor, and the fire being lighted, the "temper," which is commonly Bristol white-lime in powder, is fired into it. One great intention of this is to neutralize the superabundant acid, to get proper rid of which, is the great difficulty in fugar-making. This is generally effected by the alkali or lime; part of which, at the same time, becomes the basis of the fugar. The quantity necessary for this purpose must, of course, vary with the quality of the lime used. On the lime butt of the cane boiler. Some planters allow a pint of Bristol lime to every hundred gallons of liquor; but this proportion is, Mr. Edwards believes, generally found too large. The lime is perceptible in the fugar, both to the smell and taste, and precipitates in the copper pans a black insoluble cacoa, which corrodes the bottom of the vessels, and is not detached without difficulty. Mr. Edwards is of opinion, therefore, that little more than half the quantity mentioned above is a better medium proportion; and, in order that lees of it may be precipitated to the bottom, an inconvenience attending the use of dry lime, Mr. Boulie's method of dissolving it in boiling water, previous to mixing it with the cane-juice, appears to him to be highly judicious. In some parts of Jamaica, where the cane-liquor was exceedingly rich, Mr. Boulie made very good fugar without a particle of temper. Too much temper is perceptible in the fugar, both to the smell and taste; it might be added, and also to the sight. It tingles the liquor first yellow, and, if in excess, turns it to a dark red. Too much temper likewise prevents the mellasses from separating from the fugar, when it is potted or put into the hoghead.

As the fire increases in force, and the liquor grows hot, a fcum is thrown up, which is formed of the mucilage or gummy matter of the cane, with some of the oil, and such impurities as the mucilage is capable of entailing. The heat is now suffered gradually to increase, until it rises to within a few degrees of the heat of boiling water. The liquor must by no means be suffered to boil; it is known to be sufficiently heated, when the fcum begins to rise into blisters, which break into white froth, and appear in general in about forty minutes. The damper is then applied, and the fire extinguished; after which, the liquor is suffered to remain a full hour, if circumstances will permit, undisturbed. During this interval, great part of the fecundities and impurities will attract each other, and rise in the fcum. The liquor is now carefully drawn off, either by a fision, which draws up a pure defected fream through the fcum, or by means of a cock at the bottom. In either case, the fcum sinks down unbroked as the liquor flows, its tenacity preventing any admixture. The liquor is received into a gutter or channel, which conveys it to the evaporating boiler, commonly called the "grand copper;" and, if originally produced from good and untainted canes, will now appear almost, if not perfectly, transparent. The merit of introducing into Jamaica the clarifiers at present in use with fisions and dampers, was claimed by Mr. Samuel Sainthill; and an exclusive patent, to secure his claim, was granted to him in 1778, by an act of the assembly.

The advantage of clarifying the liquor in this manner, instead of forcing an immediate ebullition, as practised formerly, is visible to the most inattentive observer. The labour which it saves in fscumming is wonderful. Neither can fscumming properly cleanse the subjekt; for when the liquor boils violently, the whole body of it circulates with such rapidity, as to carry down again the very impurities that had come up to the surface, and which with a less violent heat would have flated there.

In the grand or evaporating copper, which should be large enough to receive the net contents of one of the clarifiers, the liquor is suffered to boil; and as the fcum riseth, it is continually taken off by large fcummers, until the liquor grows finer and somewhat thicker. This labour is continued until, from the fscumming and evaporation, the subjekt is sufficiently reduced in quantity to be contained in the next or second copper, into which it is then laded. The liquor is now nearly of the colour of Madeira wine. In the second or second fcumming fscummers are continued; and if the subjekt is not so clean as is expected, lime-water is thrown into it. This addition is intended not merely to give more temper, but also to dilute the liquor, which sometimes thicken too fast to permit the fecundities to run together, and rise in the fcum. Liquor is said to have a good appearance in the second copper, when the froth in boiling arises in large bubbles, and is but little discoloured. When, from such fscumming and evaporation, the liquor is again sufficiently reduced to be contained in the third copper, it
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is laded into, and so on to the last copper, which is called the "teache," probably from the practice of trying by the touch. This arrangement supposes four boilers or copperns, exclusive of the three clarifiers.

In the teache the subject is still farther evaporated, till it is judged sufficiently boiled to be removed from the fire. This operation is usually called "striking," i.e., lading the liquor, now exceedingly thick, into the cooler.

The cooler, of which there are commonly six, is a shallow wooden vessel, about eleven inches deep, seven feet in length, and from five to six feet wide. A cooler of this size holds a hoghead of sugarc. Here the sugar grains; i.e., as it cools, it runs into a coarse irregular mass of imperfect semi-formed crystals, separating itself from the molasses. From the cooler it is carried to the curing-house, where the molasses drain from it. It may be proper in this place to observe, that, in order to obtain a large-grained sugarc, it must be suffered to cool slowly and gradually. If the coolers are too shallow, the grain is injured in a surpurring manner. Any person may be convinced of this, by pouring some of the hot syrup, when fit for striking, into a pewter plate; he will immediately find it will have a very small grain.

But, before we follow it into the curing-house, it may be proper to notice the rule for judging when the subject is sufficiently evaporated for "striking," or become fit for being laded from the teache to the cooler. Many of the negro boileurs guess solely by the eye, (which by long habit they do with great accuracy,) judging by the appearance of the grain on the back of the ladle; but the practice most in use is to judge by what is called the "touch," i.e., taking up with the thumb a small portion of the hot liquor from the ladle; and the heat diminishes, drawing with the forefinger the liquid into a thread. This thread will suddenly break, and shrink from the thumb to the suspended finger, in different lengths, according as the liquor is more or less boiled. The proper boiling height for strong mucovado sugarc is generally determined by a thread of a quarter of an inch long. It is evident, that certainty in this experiment can be attained only by long habit; and that no verbal precepts will furnish any degree of skill in a matter depending wholly on constant practice.

This method more certain and scientific was recommended some years ago, by John Proculeus Baker, esq., barrister at law, in the island of Jamaica, in a treatise published by him in 1775, entitled "An Essay on the Art of making Mucovado Sugar." It is as follows: "Provide a small thin pane of clear crown glass, set in a frame, which I would call a 'tryer;' on this drop two or three drops of the subject, one on the other, and carry your tryer out of the boiling-house into the air. Observe your subject, and more particularly whether it grains freely, and whether a small edge of melasses separates at the bottom. I am well satisfied that a little experience will enable you to judge what appearance the whole slip will put on, when cold, by this specimen, which is also cold. This method is used by chemists, to try evaporated solutions of all other salts; it may seem, therefore, somewhat strange, it has not been long adopted in the boiling-house."

The present improved systern of clarifying the cane-liquor, by means of vevels hung to separate fires, and provided with dampers to prevent ebullition, was first suggested, says Mr. Edwards, to Mr. Sainthill, (who three years afterwards claimed the merit of the invention,) by the practice in question.

The curing-house is a large airy building, provided with a capacious melasses cistern, the sides of which are sloped and lined with terras, or boards. Over this cistern is a frame of make joint-work, without boarding. On the joists of this frame, empty hogheads, without headings, are ranged. In the bottoms of these hogheads eight or ten holes are bored, through each of which the stalk of a plantain leaf is thrust, six or eight inches below the joists, and long enough to stand upright above the top of the hoghead. Into these hogheads the masts from the cooler is put, which is called "potting," and the melasses drain through the pongy stalk, and drop into the cistern, from whence it is occasionally taken for distillation. The sugarc, in about three weeks, grows tolerably dry and fair. It is then laid to be cured, and the process is finished. The curing-house should be close and warm, as warmth contributes to free the sugarc from the molasses.

Sugar, thus obtained, is called "mucovado," and is the raw material from which the British sugarc-bakers chiefly make their loaf, or refined lump. There is another fort, which was formerly much approved in Great Britain for domestic purposes, and was generally known by the name of Lisbon sugarc. It is fair, but of a soft texture, and in the West Indies is called "clayed sugarc." The process is conducted as follows: A quantity of sugarc is put into conical pots or pans, called by the French "formes," with the points downwards, having a hole about half an inch in diameter at the bottom, for the melasses to drain through, but which at first is closed with a plug. When the sugarc in these pots is cool, and become a fixed body, which is discoverable by the middle of the top falling in, (generally about twelve hours from the first potting of the hot sugarc,) the plug is taken out, and the pot placed over a large jar, intended to receive the syrup or molasses that drain from it. In this state it is left, as long as the melasses continue to drop, which it will do from twelve to twenty-four hours, when a stratum of clay is spread on the sugarc, and moistened with water, which oozing imperceptibly through the pores of the clay, unites intimately with, and dilutes the molasses; consequently more of it comes away than from sugarc cured in the hoghead, and the sugarc, of course, becomes too much the whiter and purer. The pots remain for twenty days in this situation, after which the sugarc is taken out, dried in the sun for some hours, and then taken to a large warm-room, where it is kept in a pretty airinglest for three weeks. The process, according to Sloane, was first discovered in Brazil, by accident. "A hen," says he, "having her feet dirty, going over a pot of sugarc, it was found under her tread to be whiter than elsewhere." The reason appointed for this process is not universally adopted in the British sugarc islands is this, that the water, which dilutes and carries away the melasses, dissolves and carries with it so much of the sugarc, that the difference in quality does not pay for the difference in quantity. The French planters probably think otherwise, upwards of four hundred of the plantations of St. Domingo having the necessary apparatus for claying, and actually carrying on the system. The loaf in weight by claying is about one-third; thus, a pot of 60 pounds is reduced to 40 pounds; but the melasses which are drawn off in this practice be reboiled, they will give nearly 40 per cent. of sugarc; so that the real loaf is little more than one-sixth; but the distillery, in that case, will suffer for want of the melasses; and, on the whole, Mr. Edwards believes that the usage of the English subscribers in shipping mucovado sugarc, and distilling the melasses, is more generally profitable than the system of claying.

The Cochinichine prepare a very excellent mollet sugarc, remarkably cheap, by a very simple process, similar to that of claying. The grained sugarc, after the gros syrup has drained from it, and it has become considerably solid, is placed
SUGAR.

placed in layers about an inch thick, under layers of the
tame dimensions of the herbaceous trunk of the plantain tree;
the watery juices, exuding from which, form like congealing,
and leave the sugar very white and porous, like a honey-
comb. This is puré enough to dissolve in water, without
any sediment.

F. Labat says several different kinds of sugars, pre-
pared in the Caribbees, viz. 
Crude sugar, or mufucado sugar;
strained, or brown sugar; earthen, or white sugar in powder;
refined sugar, either in powder or loaves; royal sugar; candi-
ded sugar; sugar of fine syrup; sugar of coarse syrup; sugar of
the gum.

SUGAR, Crude, or Mufucado, is that first drawn from
the juice of the cane; of which all the rest are composed. The
method of making it is that already described as for sugar
in the general.

SUGAR, Strained, or Brown, though somewhat whiter and
harder, does not differ much from the crude sugar; though
it is held a medium between this last and the earthen sugar
which is the white powder sugar.

The preparation of this is the same as that of the mufucado,
with this difference, that, to white it, they strain the
liquor through blankets, as it comes out of the first copper.
The invention of strained sugar is owing to the English, who
are more careful than their neighbours in the prepara-
tion of it: for they not only strain it, but, when boiled,
put it into square wooden forms, or moulds, of a pyramidal
figure; and when it has purified itself well, they cut it in
pieces, dry it in ovens, and barrel it up. See Refining of
SUGAR, infra.

SUGAR, Earthen, is that which is whitened by means of
earth laid on the top of the forms it is put in to purify itself.
See Refining of SUGAR.

SUGAR of the Scum. This is all made of the scum of the
two last copperers; those of the former being reserved for the
making of rum.

The scum defined to make sugar is kept in a vessel for
that purpose, and is boiled every morning in a copper set
apart for that use. With the scum, is put into the cooker
a fourth part of water, to retard the boiling, and give time
for its purifying; when it begins to boil, the usual ley is put
in, and it is carefully scummed; when almost enough boiled,
lime and alum-water are thrown in; and when it is ready
to be taken out, they sprinkle it with a little powdered
alum.

SUGAR of Syrup, or Treacle. There are three kinds of
syrups that run from sugar. The first, from the barrels of
raw sugar, which is the coarsest of all; the second, from the
forms, or moulds, after they are perforated, and before
they receive their earth; the third, that coming from the
forms after they have had their earth; which last is the
best.

The coarse syrups should only be used for rum, but sugar
being grown dear, endeavours have been used to make some
of them, and that with tolerable success. They are first
clarified with lime-water: and, when boiled, are put up in
barrels, with a sugar-cane in the middle, to make them purify
themselves. After twenty days, a quantity of coarse earth
is thrown in, to make them cast the remainder of their syrup,
and sit them to be returned into a crude sugar. The Dutch
and German refiners first taught the islanders how to turn
their syrups into sugar.

The second syrup is wrought somewhat differently: after
the copper it is to be boiled in is half full, eight or ten
quarters of lime-water are cast in; it is then boiled with a
brisk fire, and carefully scummed; some add a ley, and others
none. F. Labat takes the former method to be the better,
though it requires more trouble and attention. This sugar
may be earthed alone, or at least with the heads of loaves,
the dried tops, and such other kinds of sugars as may not
be mixed with the true earthed sugar, nor yet with the crude
sugar.

For the third syrup, after boiling and scumming it as the
former, they put it infantly into coolers, the bottoms of
which are covered half an inch thick with white sugar, very
dry and well pounded; and the whole is well stirred to incor-
porate the two together. This done, they throw the
syrup over with the same pound sugar, to the thickness
of one-fifth of an inch, this stiffening the sugar in forming its
grain. When setted, and the cruft gathered at the top, a
hole is made in the cruft five or six inches in diameter.

By this aperture they fill the cooler with a new syrup,
poured gently in, which insensibly raises up the former cruft.
When all the syrups are boiled, and the cooler is full, they
break all the crufts; and, after mixing them well, put them
up in forms or moulds.

The cruft is performed in the same manner as for the
earthen sugar, from which it only differs in that it falls short
of its gluts and brightenfs; being, in reality, sometimes
whiter and finer, though of a flatter and duller white. For
the use and management of the syrup of sugar, see Refining
of SUGAR.

SUGAR, Refined. Crude sugar, strained sugar, and the
heads or tops of loaves that have not whitened well, are the
bais, or ground, of this sugar. See Refining of SUGAR.

SUGAR, Royal. The bais of this sort ought to be the
purest refined sugar to be found. They melt with a
weak lime-water; and, sometimes, to make it the white, and
prevent the time from redining it, they add alum-water.

This they clarify three times, and pass as often through a
closet cloth, using the very best earth. When prepared with
these precautions it is whiter than snow, and so transparent,
that we see a finger touching it, even through the thickest
part of the loaf.

The curious in the whole art of sugar-making, or the
reducing vegetable juices to what we call sugar, by expres-
sion, decoction, clarification, graining, claying, and ery
Realization, will find farther accounts and directions, in the
several proclamations of this art, in Pocc'is Hill, in Anguilo's
Sala's Saccrologia; in Dr. Slate's Treatise on Sugars;
in Sir Hans Sloane's History of Jamaica; Baker's Essay,
above cited; and Edwards's History of the West Indies,
vol. ii. There are also several valuable papers in these sub-
jects in the Philosophical Transactions.

SUGAR, Refining of, is the art of purifying sugar, and of
giving it a superior degree of whitenefs and solidity. The
excellence of mufucado sugars, or such as have not been
refined by the planter, but are sent home in the most crude
state, conflifts in their whitenefs, dryness, or freeness, clean-
ness and sharpenfs, or strength. The judicious refiner de-
cides upon these several qualities by the eye, the touch, and
the taste.

The first operation in the process of refining is that of
clearing the pans; previously to which they are charged,
by throwing about six quarts of fresh bullock's blood (called
fpice) into each pan, and filling it with lime-water to about
half the height from the bottom to the part in which the
brace is fixed; and when these are well stirred together, the
pan is filled to the brim with raw sugar. This mass, with a
moderate fire, will in about two hours be brought to
the verge of boiling heat; but it should not be allowed
actually to boil; and in this time the earthy particles of the
sugar, and other adventitious impurities, will be separated
from it by the effect of the heat, and the cleansing quality
of
of the spice, and thrown to the surface. About two
quarts of spice are added to each pan, within the first hour
after the fires are lighted. The cumin thus produced, which
is usually from four to ten inches thick, is fit to be taken
off, when the surface appears black and dry, and not great;
and it is gently removed with a broad skimmer into a port-
able tub, and conveyed into the cumin-cistern. Having done
this, the panman stirs together a ladleful of spice (a gr.
about a quart), and a quantity of lime-water (a gr. one or
two gallons, as the case may require); and pours this mix-
ture into each pan. When the suger is again brought to a
falsing heat, it throws up a second cumin, not so foul as the
first, which is removed as before. He then adds a fresh
quantity of spice, but less than the former, and repeats this
operation, till the sugar casts up a clean milky froth, which
indicates that the impurity is wholly extracated. The suger
is also sometimes examined with a bright silver or metal
spoon, that any remaining fouleufs may be discovered. In
the making of double loaves, powder loaves, or very fine
single loaves, it is usual to heighten the natural colour of the
sugar by the addition of a little saffron, and to complete the
grain, and to complete the granulation. Upon this sugar.
operation much of the beauty and succefs of the manu-
facture depend; for if the sugars are not firred enough,
the grain of the refined sugare will be large and loose, and its
colour not sufficiently white; but if it be firred too much,
the grains will be broken, the sugre will be distributed in its
parts, and though close and smooth, without lustre; and it
will lose considerably of its due weight. When the third
skipping is boiled, and the coolers sufficiently fired, the
contents of the pans are removed to the coolers, as before;
and thus the first stage of refining for the day is completed.
The course of the other two firings is precisely the same.

The next operation in refining is conducted in that part
of the ground-floor of a sugare-house, which is denominated
the fill-house, because all the upper floors of the house are to
be filled from this; and this operation consists in filling the
moulds with the three skippings contained in the coolers.
The moulds, in the form of inverted cones, previously pre-
cared by coating and anointing them, and stopping their
apertures with wet linen rags, are placed side by side, and
in twos or three deep: their number is to suffice for the
quantity of liquar in the coolers, which is estimated by the
number of bafons which were skippag from the pans;
and they are propped up by other moulds (commonly such
as are broken) placed with the broad end downwards, in
front of the outward rank, by way of abatement: these are
called flagers. The sugar, being previously firred in the
coolers, in order thoroughly to mix each skippag, is ladled
out of the coolers in succession, and not all at once, (unless
the fillings are small, in loaves, and always in lumps,) into
bafons conveniently situated; and these are carried into the
fill-house, where as much of the sugar is poured into each
mould as will fill about one-third of its capacity; the same
quantity is again poured into each; and at the third time
they are filled to the brim.

The moulds being filled, the next operation, which is that
of filling the sugar in them, is cauled boaling, and is de-
signed to prevent an adhesion to the mould, and to lay the
grain of the mafs even and regular through all its parts.
In this business each man takes a tool, made of waincoat,
and called a knife, and in size proportioned to that of the mould
to be filled; with this tool, keeping his hand over the centre
of the mould, he farses the sugar from its sides by succes-
sive five strokes downwards, carried all round; and when two
revolutions are performed, the sugar is allowed to rest some
minutes, until it has acquired some firmness. The moulds,
SUGAR.

being fluffed round these or three or four times, according to the direction of the boiler, are no more disturbed till they are pulled up.

The proces already described relates to sugar once refined, called single loaves: double loaves are usually cleared with the whites of eggs instead of spices, (two hundred of which are necessary to each pan,) and with fresh water instead of lime-water. With respect to the proof, one rule only can be laid down; viz. the sugar must be boiled higher as the moulds which contain it are increased in size.

The order of refining is uniformly this: to begin the first day with the finest sugar intended to be wrought, and to proceed daily with sugar of a lower quality, and of course to begin with small loaf-moulds, and to use larger moulds progressively; so that the brownish sugar will be put into large lump-moulds; for this sugar works best in large masses, and it is likewise more in demand in England than the finer kind. The use of this distribution of a refining is to enable the boiler to make a more advantageous disposition of his syrups and scums. The order of the first twelve days is usually as follows: first day, double loaves; second and third days, powder loaves; fourth, fifth, and sixth, single loaves; seventh, Prussian lumps; eighth, Canary, or pattern lumps; ninth, tenth, eleventh, and twelfth days, large lumps. To these twelve days are added four or five more, in a part of the process called bafiard-boiling; and these fifteen or seventeen days constitute a complete series, denominated a complement, or refining.

From this digestion let us now return to the fill-houfe; where the second and third fillings having been boiled off, and passed from the coolers into the moulds, in the manner already described, the panman proceeds to make over the scum which was taken off the pans in the morning, in order to extract the remaining sugar from it; the method of doing this will be hereafter explained. When it is finished, the pans are loaded for the work of the following day. In the evening, when the new-made goods are cool, and fit for removal, without damage, they are pulled up into that floor of the house which is best suited for receiving them, and where a proper number of well-fortified pots are placed in ranks for this purpose. The up-stairs man plucks out from the point of every one the flopper or rag; and pricks them in the point with an awl, the size of which is proportioned to the mould; and they are then set upon the pots.

The contents of the moulds, cleared by the preceding operations of their earthy particles and water, comfit of the vegetable salt, and an oily matter, now called syrup, but which, after the final extraction of the fats, will be called molasses. For the separation of these there is required a series of operations, which may be distinguished by the name of filtering, or draining. In twenty-four hours after the loaves have been placed upon the pots, the quantity of syrup which will have exuded from the aperture of each, will fill more than half of the pot on which it stands. When the state of the loaves has been examined, by drawing one or two loaves of each filling out of their moulds, if the syrups are not in a digesting state, they are left unclayed for two or three days longer, and the warmth of the room in which they stand is somewhat increased; but if they manifest a proper appearance, they are prepared for receiving the first clay, which is laid on either the next or the third day.

The green new-made loaves are judged to bear a healthy and promising appearance, when the syrups have quitted the broad part of the loaf, and are evenly drawn together; and when the whole surface has a compact and smooth appearance, they are fit to receive clay. When the syrup hath scarcely descended from the top or face of the cone; when the head, i.e. the narrow and moist end, is not evenly drawn off to a line; it is concluded that the sugar is over-boiled, or of an ill quality; the syrups are not in a state of digestion, and time is given, and heat added, to make them fit to receive the clay. On the other hand, if the moisture is shrunk and settled, and of a pale colour just round the apex of the cone, there is reason to apprehend that the sugar is under-boiled, or too free; in which case the surface or coat will appear loofe, and want that smoothness which the well-boiled loaves exhibit. When this is the case, they must be lightly clayed, and care must be taken that the clay be not too thin or wet. Before the clay is laid on, the thin crust, which had been formed round the edge of the mould by the motion of the hauling knife, is scraped from each loaf into the receiving box, and by preffing the face of the loaf with that part of the hand which is nearest the wrift, a small concavity is made for receiving the first clay, as well as a proper solidity to the bed on which it is intended to rest.

The first or green syrup is now taken away, and poured into large earthen jars, called gathering-pots; and the empty pots are returned to receive the moulds which had been taken from them. When they are returned to their proper places, a small ladleful of wet clay is poured on the face of each loaf. This first or green clay dries up in five or six days, and forms a cake, which is taken off, and laid by for future use. When the clay is removed, the whole surface of the loaf will be found to have shrunk under it, and the loaf is become concave in the middle. With a tool, called a bottoming-trowel, the sugar which adheres to the sides of the mould is cut away by a horizontal movement: and a small quantity of scrapings, or of lumps broken down for this purpose, is added to the loose sugar which the trowel had cut; and they are piled down together on the surface, till the whole has been brought to a good level, and to a moderate degree of firmness for bearing the next clay.

On the following day the loaves are clayed a second time; and when this clay is dry, it is removed, like the former, and each loaf is drawn out of its mould, and carefully examined; and this part of the process is called overseeing. Double loaves, fine powder loaves, and fine single loaves, will sometimes, under this clay, be found neat, i.e. the redness or brownness will have quitted the loaf, and the head, though still moist, will appear perfectly free from discoloration. The workman, however, in order to be farther satisfied, cuts off the heads of two or three loaves with the trowel; and if he is satisfied, these loaves are to be clayed no more; but he proceeds to the operation of bruising-off, i.e. of scraping off the irregularities and impurities occasioned by the contact with the clay with an iron tool, called a bruising-book; and with one corner of this a number or letter is scratched upon the level face of the loaf. To those loaves which are not found neat, the workman gives a second clay; which is usually laid on in a thinner mass than the former. If his loaves are not yet quite finished, he puts a little fresh moisture on the back of the overseen clay, and thus effects his purpose.

The loaves being now rendered neat, and bruised off, must stand some days in the moulds to acquire face, or that spongy hardness of surface, which will enable them to stand firm, when they are turned down out of the moulds; and during this time they are once or twice loofed in the moulds by a gentle blow on a floor, or against a post; and thus the coats are improved by preventing adhesion to the moulds, and facilitating the precipitation of the remaining moisture. The windows
SUGAR.

windows are opened to let air in, if the weather be dry; and the points or noes are also examined, which will sometimes melt away, whilst the above operation is effecting. When these symptoms appear, the workman proceeds to turn down his loaves, by taking the moulds from the pots, covering the floor with clear brown paper, and turning each loaf down with its mould over it. They are usually turned down either upon the floor-head, or in some warm place, because by being left uncovered, and exposed to the air, the growth of moulds, the moisture remaining in the head will not descend into the body of the loaf, and be equally dispersed; but remaining in the head, would spoil and disfigure the loaf; partly by the syrup coagulating, and becoming unfit to descend between the fine interstices of the concrete body, and partly from the attrition of the solid particles. With these precautions, in twenty-four hours the moisture is apparently dispersed, and the cone aifies throughout an uniform appearance. The loaves are then taken off the floor, separately examined, and cleared of any discoloured spots with a small knife; and are either papered and set in the floor, or else are placed in the floor without paper, as the case may require. If any of them have still a remaining yellowness in the head, the point is cut off, and they are then called foot-loaves. They remain in the floor five, six, or seven days, till they are entirely dry, and are then fit for sale and use. The management above specified in the course of this one day's work is nearly the same, whether the fugar be fine or coarse.

Brown sugars, wrought in large moulds, require more clay than fine sugars in small moulds; nor is it necessary that lumps should be made neat; but it is the custom practice to cut off the wet head from every lump, so as to leave no remaining redens; these wet tips, called lump-headings, are received into a large mould, and placed upon a pot to drain, and when dry, are melted for making double loaves, or for improving powder loaves; or else they are bruised and mixed with brushings to bottom-up, i.e. to defend the face of loaves, or other goods, before they receive clay. Large lumps frequently need claying four times. And it may be observed in general, that sugars of every kind require more heat to bring them forward, as they sink in quality.

The materials for double-loaf boiling are made from refined sugar, and frequently from loaves or lumps bought for that purpose. But those who are most curious in this fabric, chuse to make lumps for this purpose, which are called melters: they are low boiled, and fired but little (though some boilers fir them much), in order to preserve the strength of the fugar unimpaired. Fine double loaves are kept in a room of the temperature of a common parlour; a little warmth is sufficient for powder loaves, and fine single loaves; inferior loaves, and lumps of a middling quality, require warmth; but the browneft lumps and boitards thrive in a glowing heat. Every fort of refined sugar will bear and require more heat in proportion as it is higher boiled; for the brown fyrup matter will not quit the denier, unless it be kept in a fluid state; and this can only be effectcd by the action of heat; and, moreover, the fluid parts of high-boiled goods must be more viscous than those of goods which have been left bound up by fire.

The fyrups, which are discharged from refined sugar during the operation of draining, exceed in bulk and weight the whole quantity of loaf or lump fugar, and are, therefore, of great importance in this manufactury; and upon the proper management of them much of its success depends. It will be proper, therefore, to pursue the enquiry relating to the use of fyrups, produced from a day’s work of fugar once refined in loaves. When the loaves are prepared to receive the first clay, the syrup is collected into gathering-pots, each of which contains from 50 to 60 pounds of fyrup; this is called green fyrup, on account of the new or green state of the loaves from which it runs; and the quantity of it is usually about 15 gathering-pots from each pan of goods. The next fyrup, called second runnings, is commonly collected when the second clay is removed, and amounts in quantity to about eight gathering-pots per pan. The third and last of the loaves, when the moulds are finally removed from the pots; it is called drippings, and is about five gathering-pots per pan. However, some workmen collect their fyrups oftener than thrice. The fyrups of every kind of refined fugar increase in fineness and value, the later they exude from the moulds. As for the appropriation of them, the green or low fyrups are boiled away on the days next after the conclusion of refining; they are taken into the pans without the addition of any fugar, and after a sufficient evaporation are poured into large moulds; and under the name of boitard fyrup, form a principal article in the fugar-trade. The finer fyrups are all incorporated with fugar, and a proportion of them is daily brought down through the fyrup-pipes into the ciltern, at the same time in which the fugar is first skimmed from the pans; the fyrup-pipe discharging its contents into the clarifying basket, so that the fyrup, as well as the fugar, falls through the blanket; and it is pumped back from the ciltern into the pans.

The following estimates exhibit the quantity of fyrup that may be allowed (ceteris paribus) to a given quantity of fugar, viz. for double loaves, six gathering-pots per pan; for powder loaves, 10 ditto; for fine single loaves, 15 ditto; for middling loaves, 20 ditto; for brown single loaves, and Canary lumps, 25 ditto; for lumps, 30 or 40 ditto.

With the necessary allowances for particular circumstances, the several sorts of fyrups may be duly appropriated in the following manner. Green fyrups of every kind may be mixed with raw fugar, or applied to the making of goods, two degrees in quality lower than those from which these fyrups were produced. Second runnings of every kind are fit to be incorporated with goods one degree below those from which they were produced. Drippings may be used with raw fugar, or with other proper materials, in making the same kind of goods from which they had been supplied. In other words, the green fyrup of double loaves would be used in making single loaves; the second runnings would go into the composition of powder loaves; and the drippings would enter into the subflance of other double loaves. Again, the green fyrup of large lumps would be boiled off in boitards; the second running would make pieces; and the dripping, added to proper fugar, would be united therewith in the production of other lumps.

Pieces are a better kind of baifard, which are either boiled from fyrups that are too good to make baifards, or are made of such fyrups, and a small portion of cheap and bad fugar, which is too poor to make lumps. In the latter case, they are called fugar-pieces; but in either, all the fyrup that comes from them is boiled again, either to make baifards or other pieces, according to its goodnec; whereas the fyrup that runs from baifards is always considered as a caput mortuum, and no efforts are made to obtain any fugar from it, but it is put into calks, and sold under the denomination of melaffes. It is, therefore, worth the boiler's attention to keep all the weight of fugar possible in his baifards; and for this purpose he boils them as high as he may venture, without incurring the danger of making flopped baifards, i.e. baifards from which the melaffa will
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will not run; which may be owing either to the ill quality of the materials, or to overboiling. But as the syrup of pieces is to be boiled again, a good workman never exhausts it by overboiling. The materials of which bahards and pieces are composed, not abounding with fats like those already treated of, have not an equal disposition to concretion; and, therefore, it is found necessary to give them some aid, in order to effect the necessary granulation; this is done by taking grain (which we shall presently explain) into the coolers. These inferior productions are stirred, neither in the coolers nor in the moulds, any more than by a small movement round the coolers, with an iron scraper, just sufficient to incorporate the grain with the hot fluid mass.

In order to illustrate the formation of this grain, we may observe, that the strong particles of sugar, which are capable of concretion, have evidently a greater degree of density than the oily or aequous. When the hot fluid is poured into a bahard or piece mould, these denser particles descend, and would pass into the pots if there were any passage for them; but the flopper is not taken out of the moulds of these goods until five, six, seven, or eight days after they have been pulled up; for they want time to harden, and cannot safely be left unstopped. Having reached the lower part of the mould, they are formed into small very fine frustums of the nature of candy, and when the floppers are withdrawn, these small thines remain near the point of the mould, and are properly called *bathard* or *piece*, as already explained.

Bahards and pieces are usually clayed but twice, and when dry enough, are knocked out of the moulds, their wet heads being cut off into a large mould placed to receive them, and they are called *bathard-boading* or *smear*; in another mould is preserved the grain, which usually forms a stratum about two inches broad, beginning about four inches from the point of the mould. The bahards and pieces are then put into the store, and in five, six, or seven days, will be found dry enough; for they must not, like lumps and loaves, be rendered perfectly dry. They are then taken out and piled in a room, as near as may be possible, and ground all together; or the brown tip is cut off, and the other two parts, called the middle and face, are ground together: or sometimes the bahard or piece is divided into three parts, which are ground separately, and sold at different prices.

We shall now close this article with a short account of the method of making over *scums*, and the application of their produce. The refineextracts from the scum of his sugar, every particle of sugar which it is in his power to obtain; and after he has reduced the scum to such a rate that it appears to be a mere earth, resembling garden mould, he sells it to a scum-boiler, who again tries it over the fire, and extracts a small quantity of sweet liquor out of it.

The scum of fine treble or double loaves is often put into the pans again without any procès, and mixed with raw sugar, for the production of inferior goods: but, in general, the scum of each day's work is made over in the same day after the boiling of the sugar is finished. The method is this; the panman, having put about three quarts of spicce into his pan, draws lime-water until the pan be four-fifths full without the pan-brace; to this he adds about four tubs of the scum, each tub containing about three-fourths of a hundred-weight. Having flurred the liquor well, he makes a moderate fire, and the scum will separate from the fluid and float upon the top of it; with a small iron scraper he prevents any foulness from adhering to the bottom of the pans; and then suffers the fire to increase, and the liquid, upon the verge of boiling, is seen through the openings of the dirty surface. Having kept it simmering for several hours, and having provided a cooler or receiver, over which is placed a strong wooden frame, and upon this a balket, to which a coarse bag, called the *fum-bag*, is fitted, he pours the contents of his pan into this balket and bag; and then the mouth of the bag is drawn up, and well twisted together, and a strong board, called a *fum-board*, is laid upon the bags, with several weights upon the board, to press down the fum. In the space of an hour, or an hour and a half, the bag should be twisted and prefixed; and the liquor, which oozes plentifully through the bag, is usually taken into the pans the next morning: its thinnes renders it useful in clearing the pans, and if any groat matter hath passed through the bags, it is drawn off with the rest of the scum of the fugar when cleared. The fum, as it is taken from the pan, is called *fum*, and the liquid matter drawn from it bears the same appellation; in contradistinction to the poor meagre liquor which is exprized from the same fum when they are made over a second time, by an operation much like the former. After prefilling and draining, the exhausted remains, under the name of *rubish fum*, are either burnt in the cockell, or delivered to the scum-boiler at a very low rate. The produce of over-made scums must be used immediately, or it must be shortened, *i.e.*, boiled thick; otherwise it will turn four and do great harm; for acidity is a confant enemy and destroyer of sugar.

The liquor drawn from these scums is commonly used in bathard boailing, or in the brownet lumps. There is a large proportion of the fat fum usually left of every refining, to be made over during the bathard boailing; it is common to let by the first or grossest fum for this purpose, and to keep separate the finer and later scums, which are made over day by day in the manner already described: the liquor thus obtained from the fat scums, being full of sugar, is very useful to the bathards, fortifying the syrups, and promoting their strength and adhesion. The editor is indebted for the materials which have supplied this article, and those on the manufacture of sugar-candy, and the construction of a sugar-boufe, to the kind communication of Mr. Griffin, an eminent sugar-refiner in London.

Of the improvements that have been made in the processes for refining of sugar, we shall give an account according to the order of time in which the patents were granted. In October 1812, Edward Charles Howard, esq. of Welfbourn Green, in the county of Middlesex, obtained a patent, the specification of which informs us, that he has established and adopted the following operations. In the first instance, he submits raw or muscovado sugar to a primary operation, by well mixing, as expeditiously as possible, the laied sugar with such a quantity of water as will, at the common temperature of the atmosphere, bring it to a magma of the confluence of well-worked mortar: having left it at rest for the space of an hour or more, he heats it to a moderate temperature, *e.g.* from 190° to 200° Fahr., which is most conveniently effected in a vessel surrounded by boiling-water or steam, under the common pressure of the atmosphere; he then adds more sugar, or a thicker magma, to make up the mass and to fill it with the water-bath; and when it is become cold in the moulds, he takes the flopper out of the mould, and suffers the melleas to drain from it. When the drain-
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cold water, till the magma acquires a consistency, which will not allow it to readily cloe behind the fixar; and then replaces it, in that condition, upon the uniform and firm surface before prepared; and as soon as the magma becomes moderately dry, he pours upon it, with the intervention of a float or similar guard, a cold saturated solution of fine sugar in cold water, about half an inch deep; or, he takes off the said magma down to the surface of the lump, loaf, or mafs, left after the first paring, and remixes the fame with water to a thinner consistency than last-mentioned, and again replaces it as aforesaid; and he repeats the said operations by this magma, or with a cold saturated solution of finer sugar than that which he intends to refine, to the increased purity and quality. He farther declares, that when the sugar proves extremely cloe-grained, and the surface extremely hard, an unsaturated solution of sugar, or even water itself, may be poured on it, without running in; but this process requires too much nicety for general practice. When the sugar proves open-grained, the finer the sugar, the better, because the moisture thereon is thereby prevented from descending too fast or unequally into the loaf. It is not necessary, that the sugar taken from the surface of the loaf should be used as magma or syrup upon it.

The fit time for terminating this primary operation is ascertained either by drawing from time to time one of the lumps, loaves, or mafs so prepared, or by observing the greater or less freedom with which a new moisture is admitted, and the colour of the mafles dripping out. It is farther declared, that it is most beneficial in conducting this process, to leave the temperature of the place or apartment in which the mafles are placed, previously to their being crested with the magma, to about 60°, and again to raise the same to about 75° wherewith the surface of the loaf becomes dry for the last time. It will be necessary, in every case of the percolation of mafles or syrup, to pierce, perforate, or break the dry surface of the mafs of sugar in the mafles, when it is become so solid or iced over as to prevent the access or escape of the air into or out of the sugar, and thus to impede or prevent the flow of the mafles or syrup.

This primary operation being finished, the operator does in the usual manner break or draw out the lumps, loaves, or mafs, and separate the neat or good sugar from that which retains mafles, referring the latter to be mixed up with raw sugar, for a subsequent preparatory operation, such as has been already described. The former is then refined by pouring upon it, in any convenient vessel, 6 lbs. of water (boiling-hot) to every 5 lbs. of sugar, deducting about 6 per cent. for the moisture previously contained in it; and having infused a perfect diffusion of the sugar, by farring, the impurities are allowed to subside, and then the solution is drawn off from the said impurities into another clean suitable vessel; and in order farther to clarify and separate impurities and colouring matters, the ordinary finings are added. These finings are prepared by making well-burned lime with boiling water, so as to obtain a cream of lime; to this is added about an equal bulk of water, and the mixture is boiled for some minutes, until the lime assumes the appearance of fine curd; the extraneous matters or lumps, always contained in lime, are separated by washing over, or, as the chemists term it, by the procès of elucion; and that this may be done effectually, the lime and liquor so washed over, are made to pass through a fine anneal sieve as will admit the passage of the finest curds. The next part of this process is to diffuse about 24 lbs. of alum for every cwt. of solid sugar that is to be refined in about 16 times its weight of water, and to add to this solution about 70 or 80 grains of whiting for each pound of alum; and after farring up the mixture till the effervescence ceases, the suspended finitures are allowed to subside, and the solution is drawn off from the precipitated matters, and then are put into it the prepared lime-curds, shook up with the water they retain (the whole being agitated during the effusion) in such quantity of the curds, so that paper stained with turmeric shall barely change its colour by immersion in the mixture, and shall recover its former yellowness when dry, and shall, by immersion in the clear supernatant liquor, after subduction, be scarcely changed at all. The finings, thus duly prepared, are suffered to settle to the bottom of the containing vessel; and after draining off the supernatant liquor, the said finings are placed upon blankets, supported in the manner of a filter, and the moisture is drained off till the mafs begins to contract, and separate by cracks in it; and in this last state the said finings are fit for the clarification of the sugar last drawn off, as above described.

Such a quantity of that solution, or of any other similar solution of sugar, is added by degrees, and with farring, as will bring them to an uniform creamy state. This mixture is then poured into the whole quantity of the said solution of sugar prepared or intended for clarification as aforesaid, with sufficient agitation for diffusing the finings equally.

The refined or clarified sugar is then suffered to remain, either during the night, or for about six hours, and the bright liquor drawn off from the finings, in the usual methods; and an evaporation is commenced and carried on at the temperature of about 200°, which is best effected by the heat of flame, or water under the common pressure of the atmosphere, until the hot liquor shall have acquired a specific gravity of about 1.37 (tan. of water being 1.00); and in this state the same is transferred to any convenient vessel, and thinted frequently, until it assume the proper granular consistence to fill the moulds, and accordingly the moulds are filled with it. The fillers are then taken out from the moulds as soon as they become cold, and the syrup naturally contained in the lump, loaf, or mafs, is allowed to run off from it in the usual manner: during the farring operation, and when the farring has left the upper surface of the lump, loaf, or mafs, the farrings is pared down, before described; and if the farring appear sufficiently fine, then, in the intermediate consumption, or market, it is taken out of the mould, after it ceases to drip, in the usual manner, the smaller end of the loaf not clear of syrup being cut off; and it is then dried in the ordinary mode. But if the lump or loaf be not sufficiently white, the farring before pared off the surface is mixed up to a magma with water, as in the primary operation. If the loaf, as above prepared, be not sufficiently dense or cloe in its grain to satisfy the consumer, the loaf, previously to drying, is remoulded, according to the usual practice, by flamping the grains into a metallic or other mould, which will immediately redivide the farring. If it be required to retain the point of the lump, loaf, or mafs, without returning the syrup contained in that point upon its body, this derivatatum is effected by the appendage of a pipe, applied and fixed to moulds of the usual construction, having the aperture enlarged to one inch at the leaf, or to form part of a new mould, which is to be fabricated on purpose; then the lower portion of the farring is taken off, which will be contained in the said pipe, along with the redundant syrup, instead of taking off the point as usual.

To the first of the liquors left in the two great or other vessels which contain the insoluble impurities, is added about its bulk of boiling water, and it is then passed through a cloth
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a cloth sufficiently close in its texture for retaining the gross impurities; and the second liquor, containing the above-described finings, is added, abstracting from them, by washing and subduing, all the sweet they contain; which sweet liquor is used for magma. The syrups, which drain from the magma which have been subjected to the action of finings, may be evaporated without any addition, provided the boiling temperature be avoided by means of the flame or water-bath above-mentioned; and such syrups will, by such treatment, afford strong crystals a second, third, or even fourth time. Or, otherwise, sugar remaining from top-parings, cut-off points, or any other remnants, may be melted in them, upon the water-bath, to bring the flame up to their crystallizing densitv or granular consistence; and the inferior syrups may be advantageously mixed with mucovado sugar instead of water, in the manner stated in the account of the primary operation.

The lumps, loaves, or maffes of sugar which have been refined by the use of the ordinary or common finings, or any other sugars in a forward state of refinement, may be further refined by the application of further finings, prepared in the following manner: by diffusing about three pounds and a half of alum for every hundred weight of solid sugar, in about sixteen times its weight of boiling-hot water, and adding to such solution about seventy or eighty grains of whiting for each pound of alum; and after stirring up such mixture till the effervescence ceases, allowing the suspended substanaces to subside, and drawing off the solution, pouring into it (instead of the lime-curls in the ordinary finings) a concentrated solution or ley of caustic soda, until the agitated mixture shall produce a very slight film upon turmeric paper; and then adding to it the fairest water, wafching the precipitate by alternate diffusing of any-bulk charcoal, &c. and afterwards reduced into smaller pieces or powder. 3dly. Bituminous earths, commonly called coals, either in the state in which they are mined, or articles of their products after fusion, and reduced, as before-mentioned. 3dly. Certain argillaceous earths, known by the name of ochres. 4thly. The vegetable charcoal, usually called lamp-black. The first-mentioned articles, however, are preferred in the processes of refining and clarifying sugar; which renders the sugar so clarified much whiter than by the heretofore common methods of clarifying sugar. The following is the most convenient process of refining sugar, from which one of the above-mentioned finings is preferred. We charge, say the patentees, or fill our boilers or pans with sugar and water, or lime-water, as in the common and well-known methods of refining sugar, only sometimes preferring to add a little more water or lime-water than in the common mode of refining, as it generally more easily and effectually separates the animal charcoal, or other substanaces, from the liquid sugar. And we also add to the above sugar and water in the boiler the substanaces before-mentioned, in any quantity, according to the quality of the sugar to be refined or clarified; though we generally prefer from two to five pounds of charcoal or earths before-mentioned, to and for every hundred weight of sugar to be refined or clarified. And, farther, we pour into the boiler the usual finings of eggs, blood, or other albuminous matter, in rather larger quantities than in the usual mode of refining, in order, in some degree, to coagulate and combine the animal charcoal, or other substanaces, with the dirt contained in the sugar. We now well stir up and agitate the liquor in the boiler, in order that the animal charcoal, and other substanaces, may have the greater effect in blanching the liquor. And after the coagulated albumen has completely risen in the form of scum by the application of heat, in the usual way, we either skim it off, as in the common processes, or we pour the whole of the liquid sugar and scum into and upon the
the usual or any other known filter, when this clarified liquor is completely separated from the albuminous matter, as well as from the animal charcoal, or other substances employed; taking care to return back into the filter the first runnings of the said liquor, if not quite separated from the above substance used. And, further, we proceed in the usual manner to evaporate, granulate, and refine the said refined sugar. And further, we boil over and filter our liquor in the usual manner. We further declare, that the sugar so clarified and refined is preferable to sugar refined in the heretofore common mode, inasmuch as it is purer and whiter. And we further declare, that the syrups obtained by these processes have not that tendency to ferment which the syrups have which are produced in the heretofore usual method.

A patent, dated June 29th, 1815, was granted to John Taylor of Stratford, in the county of Essex, manufacturing chemist, for a method or methods of purifying and refining sugar. The patentee, in his specification, declares that his invention is applicable to the purification and improvement of raw sugars, if employed in the original manufacture in the West Indies; or that the said raw sugars, as now commonly imported into this country, may thereby be improved in quality here, so as to render the subsequent operations of refining less complex and expensive than when raw sugar not so purified is employed. The patentee states the nature of his invention to be as follows: "I have found that the melasses and other soluble impurities contained in raw sugar may be separated therefrom by mechanical means, without the use of heat; and that, by abstraining these from the raw sugars, the injury caused by their mixture with the refined sugar in crystallization is avoided. For purifying raw sugar according to my invention, it must first be brought to a moist state; and if the process be employed in the original manufacture in the West Indies, the degree of moisture at which the sugar will be upon draining a short time after it is taken from the coolers in which it is crystallized, will be sufficient. But if my said invention be practiced in this country on sugars as dry as they are usually imported, they will require to be mixed with a certain proportion of cold water, or lime-water. This proportion may be varied according to the opinion of the operator and the quality of the sugar, and will readily be determined by trial, as no exact rule can be laid down for each case;—in general, the proportion of water may be from one-eighth to one-tenth of the weight of the sugar. The sugar and water are to be well mixed in any proper vessel, and the whole is then to be subjected to preasure, carried to such a degree as to express all the fluid part therefrom, which will be found to contain the melasses and soluble impurities, and a certain quantity of sugar in solution; and the sugar, if the preasure be sufficient, will be rendered dry, and much improved in colour and appearance.

"I further declare, that though my invention may be carried into effect in a variety of ways, by using preasses of various construction, and by exposing the sugar to preasure in a variety of modes, yet that the following operation is the one which by preference I adopt. After the sugar has been mixed with water, or otherwise moistened, I inclose it in strong linen or woollen cloths, each of which is cut about thirty inches square, and being laid over a wooden box twelve inches square and two inches deep, some of the moistened sugar may be pressed in, and the cloth folded round it so as to form a square cake. A press is to be constructed with a platform, capable of containing at least four piles of these cakes, which may be arranged so as to stand at a certain height, and may then receive a degree of preasure, which will cause the fluid part to flow out, and which is to be received in a copper pan, fixed upon the platform of the press, and furnished with a spout, to convey the expressed syrup into a receiving vessel. While these cakes are preassing, another set is to be got ready, and the first having been hardened with preasure, may be adjusted so as to keep the piles upright, and the fresh cakes let upon them, and so exposed to preasure. In this way a considerable quantity of sugar may be got into a press, and, after having been moderately hardened, the whole should be taken down, and again set up, and exposed to a higher degree of preasure, which will render the whole dry, and of uniform good colour and appearance.

"I further declare, that any machine or apparatus is capable of applying preasure to sugar, either vertically or horizontally, and whether the sugar be inclosed in cloths, as I have described, or in bags, or in cases, frames of wood, metal, or other materials, may be used for the purpose of my invention; but that I prefer the mode I have herein pointed out; and that I have found the hydrostatic presses, and commonly known by the name of Bramah's presses, most convenient for the purpose.

"And I further declare, that the sugar prepared and purified in the way I have described is much improved, and may be refined into lump-sugar by any of the processes for that purpose, and with less expense and trouble, and in less time, than is required for raw sugar not so purified. And further, that if my said invention be applied to the original manufacture of sugar in the West Indies, the sugar so prepared will be fit for immediate shipment, as all the time required for draining and drying will be saved, and all danger of fermentation prevented.

"And I do further declare, that the sugar contained in the expressed syrups may be obtained therefrom by the usual processes of evaporation, and from its not being injured by the usual application of heat, is capable of being made into an inferior sort of refined sugar."

Sugar. Barley, Saccharum borde tum, is a sugar boiled till it be brittle, and then cast on a stone anointed with oil of sweet almonds, and formed into twisted sticks, about the length of the hand, and the thickness of a finger. It should be boiled up with a decoction of barley, whence it takes its name; but, in lieu of it, they now generally use common water, to make the sugar the finer. To give it the brighter amber colour, they sometimes cast sugar from it. It is found very good for the cure of colds and rheums.

Sugar-Candy, Saccharum candum, or Crystallinum, is sugar depurated and crystallized, and differs from common sugar in being much harder and transparent. See CANDY. The sugar to be used in this process is first diffused in a weak lime-water, then clarified, scummed, strained through a cloth, and boiled, and put in forms or moulds, that are traversed with little rods, to retain the sugar as it crystallizes. These forms are suspended in a hot floe, with a pot underneath, to receive the syrup that drops out at the hole in the bottom, which is half-stopped, that the filtration may be the gentler. When the forms are full, the floe is shut up, and the fire made very vehement.

Upon this, the sugar fastens to the sticks that cross the forms, and there hangs in little splinters of crystal. When the sugar is quite dry, the forms are broken, and the sugar is taken out candied. Red sugar-candy they make, by casting into the vessel, where the sugar is boiling, a little juice of the Indian fig; and if it is desired to have it perfumed, they cast a drop of some essence in, when the sugar is putting into the forms.

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This method of making sugar-candy is that of F. Labat, practiced in the Caribbees.

The method among our manufacturers is as follows. A fove is set apart for this purpose; the entrance into which is in the ground-floor, and as near as possible to the pans; and the top is usually from ten to fourteen feet above the ground, and covered like the top or crown of an oven. Beams are fastened into the walls, at the distance of about twenty-six inches from each other, and sufficient to bear a large weight; upon which strong planks are laid when they are wanted, and upon the planks the candy-pots are set; when the fove of candy is finished, the planks are removed. The pots are usually made of thin copper, without feet, and with an iron rim round the top, to strengthen them; the bottoms are hammered into the mof perfec flatlets, that they may stand firm and steady: they are perforated in rows on two sides with holes about one-tenth of an inch in diameter. According to the old method of piercing, the holes were very close laterally, and the candy of each firing united with that of the next, and the whole formed a strong cake; but according to the improved method, the holes are kept at a proper distance apart, i.e. at the distance of one inch and a half in the upper rows, and widening downwards to two inches; and the candy is formed in different bars, more convenient for package and sale, and much more beautiful than the former.

When a fove of candy is intended to be made, the cockell should be moderately heated, at least twenty-four hours before the operation begins; and the candy-pots are filled. i.e. a coarse white thread is drawn by a needle through the first hole of the bottom row, and the end being fastened there, the thread is led across the infide of the pot to the opposite hole, and continued from side to side, till that row is finished; the next row above it is then filled in the same manner, &c. till every row is finished. The pots, being all filled (viz., about forty to each pan of sugar), must be pasted, i.e. the holes must be stopped either by pasting papers over them on the outside, or by brushing any glutinous matter over the outside. When the foves and pots are ready, the workman places five pots upon the pavement, beginning either at the right or the left-hand corner of the fove opposite to the cockell.

The management of the pans is nearly the same as has been described under Refining of Sugar, with some small differences. The fugar intended for candy should be cleared with lea water and otheroods; the lime-water for brown candy should be of the greatest strength; and the workman endeavours to extract the scum as soon as possible, because it is imagined that the strength of the sugar may be impaired if it be suffered to lie too long discolored. No scum is ever incorporated with the fugar intended for candy; indeed four or six gathering-pots to a pan are sometimes taken; but it is apprehended, that it would be better to omit even this. The fugar melted for candy should be the strongest that can be obtained.

When these precautions have been observed, let us imagine the fugar cleared off and skimped into the cittern. The panman pumps back about the usual quantity: the boiler carries the evaporation to the point he judges proper; and it is immediately skimmed off into bafons, which are carried directly to the fove; and the pots are then filled in the following manner. The full-house man receives the first bafon, and pours its contents into No. 1, proceeds to No. 2, and so on, till he has reached No. 5; and then proceeds to fill No. 5, 4, 3, 2, and 1. When this is filled, the full-house man goes on till he has covered the whole pavement; he then lays two planks upon the lowest beams, and places a series of pots upon the farther one, standing upon the other to fill them; he then lays down another strong plank, and covers that on which he stood, and so proceeds to build up row after row, till the whole is filled. In the whole process of this business he moves slowly and cautiously, and causes all the doors to be shut, so that no currents of air may approach him; as skillless is of the greatest consequence, and the least confluence of the air is sufficient to disturb and break the crystallization. When the pots are filled, the fove-door is fastened up, and covered with a blanket, or dropped with wet clay. The cockell is foked to such a degree, that the candy may stand in a blood-heat; at the end of five or seven days, the crystallization of brown candy will be complete. The pots are then removed from the planks and the floor, and the operation commences, which is called ferring, or breaking-up a fove of candy. Each pot is brought to the side of a cooler, upon which, over a frame, a clean basket is laid, into which all the sugar that has not crystallized is poured off, and along with it the currif, which is a cast of candy, that had formed itself upon the surface; the fypur or uncrystallized fugar runs through the basket into the cooler, but the crust remains in the basket, in which it is washed and dried, and afterwards packed for sale with the candy. As soon as the fypur is poured off, the pot is brought to the side of a clean water, blood-warm, are poured in till it be nearly filled; the pot is then smartly shook round, and the water is returned into the pan. The candy being thus worked, the boiler examines it. If it be strong and good, it presents a beautiful appearance; the sides of the pot are everywhere covered with a coat about half an inch thick, the front of which is cut in fancy forms, reflecting the light in various directions; and upon every line the crystals fall in the most varied and capricious forms. If the pots were pierced, as they formerly were, so that the fringes might lie but an inch asunder, the candy of each line would then run into the next, their sides become united, and the whole form a strong cake, not to be separated without force; but the modern improved pots are so pierced, that the crystals are suspended upon every thread in different bars, without either lateral or perpendicular cohesion.

The washing above described is necessary to cleanse from the face of the crystals every particle of fypur matter, which would otherwise occasion a clamminess in the candy, and obscure its luster. After washing, each pot is turned down into a cooler or other receiver, and when they are washed and drained, they are again put into the fove to be dried; for this purpose they are placed in the fove aflant, resting against the wall, or against each other, with the mouth downwards; and under each pot is placed a small earthen pan, called a candy-bafon, to receive the remaining moisture which will drip from them: the fove is again fastened up, and the cockell foked, so as to produce a fierce fire, which must be well kept up for three days: at the end of which time the candy will be dry enough to quit the pot; they are therefore taken out of the fove, and turned down upon the floor, previously covered with clean paper; and with a little flaking, or a gentle blow, the whole mass of candy quits the pot, retaining the form of it complete: and then the candy is returned to the fove for the third and last time, where in three or four days, with a good fire, it will become perfectly dry, and fit for sale. It is generally packed in boxes of about fifty-five pounds each; at the bottom of the box is a layer of the bottoms of the pots, which have the least beauty or fineness; then a course of bars of candy, upon that a stratum of crust, and so on to the top of the box, finishing with bars of the bandfomest candy.
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candy, nearly laid with the face upwards. At the bottom of the candy there are often found masses of sugar which hath not yet crystallized, but is become concreted in small round grains, of a lighter colour than the candy; this is called fool, and is either sold at a lower rate, under the name of candy-foot, or melted with other sugar, for the making of lump and loaves. The syrup of candy is fit to be taken copiously with raw sugar in lump-boiling. The washings and the drips from the bafon are applicable to the same use.

White-candy is made like the former, but from fine lump or loaf sugar, cleared as for double loaves. It is boiled to lower proof; stands in a milder warmth; forms in three days instead of seven; and the value depending upon the whiteness, it must be managed with the utmost delicacy in every stage of the process.

The brown froth crystallizes as regularly as the white, but becomes clammy and deliquescenit in a damp air, whereas the white candy remains always dry. On account of its superior hardiness, it is less easily soluble than the loaf-sugar, and would be excellently calculated for preparing all vegetable food, if the price was lower. The sole difference between the white candy and the finest loaf appears to be in the form, which in the candy is the natural flake form of sugar, but in the loaf is granular, owing to the agitation given to it for this express purpose whilst cooling. The most common form of the regular crystals of sugur-candy is an oblique four-sided prism, terminated by dihedral summits. White sugar-candy, and also sugar, are used as ingredients to render water a vehicle for colours in miniature-painting. The intention of using them is to prevent the colours from cracking when mixed with gum-arabic, and also to make the gum-water work more kindly with the pencil. See Starch.

Sugar-Houses, is a brick or stone building, constructed for a sugar-refining manufactory. A house intended to contain one or two pans should be square, or nearly square: but a house of larger dimensions ought to be of an oblong form; as it may be conveniently heated, by placing the chimney of the stove and of the pans at opposite angles. A house to contain one pan should consist of fix floors besides the ground-floor; the dimension about twenty-seven feet square; a two-pan house about thirty-six feet by forty feet; a house of four pans, about forty feet by sixty or sixty-five feet. The stove is a brick building from eight to fourteen feet square, usually placed in one corner of the building. The height of the several stories should be as follows; the fill-hose, or ground-floor, nine feet below the girders; the next floor above it, called the ware-house, of the same height; and every other floor upwards, fix feet at most between the girders and the floor. In every floor must be left an aperture, through which a rope is fastened upon a brafe pulley upon the uppermost floor for drawing up the sugars: and provided due attention be given to the strength of the building, and to the exclusion of dams and a cold air, a sugar-house cannot be rendered too light. The utensils necessary to a sugar-house are of copper, lead, iron, carpentry, back-maker’s work, wicker-work, pottery, &c. The copper utensils are the pans, coolers, cisterns, syrup-pipes, bafons, ladles, skimmers, and, in some cases, candy-pots, &c.

The pans are usually made of a conical form, from five to fix feet diameter at the top, decreasing to a diameter of about two feet fix inches, or three feet. The coolers are vessels of thin copper, of fix feet in diameter, and about twenty inches high: the number of pans and coolers is usually the fame. The clarifying cistern is a large receiver, either of copper or lead, placed as near as possible to the sides of the pans, and capable of containing at least one-third more than the contents of all the pans collectively. The syrup-pipes are tubes of four inches diameter, made of thin copper, or tin-plates, and suspended perpendicularly over the clarifying cistern, from the upper floor through the whole building. The bafons are vessels containing from four to fix gallons each, in which the boiled sugar is carried from the pans to the coolers, and from the coolers to the moulds. The ladles are of several sizes. Skimmers are of fourteen inches diameter, pierced with holes like a clynder; and likewise a small one of the same kind. Cullenders are of eighteen inches diameter, and fourteen inches deep, through which the clay is to be strained; and there is also another, which is smaller, for the purpose of straining spice.

The leaden utensils and plumbers’ ware, are such as follow: the bench is a shed about one foot broad, running before the pans, and rising in front, by which it is capable of receiving the sugar which is spilled before the pans. The clem-cistern is a wooden receiver, usually lined with lead, and nearly as large as the clarifying cistern.

The sugar-pipes are a pewter or hard metal pipe from the lime-cistern to the pans, and leaden pipes for the conveyance of common water or liquor to the pans, and to the lime-cisterns. The pumps are a copper pump fixed in the clarifying cistern, and a spare pump of the same kind.

The iron-founder supplies bars of a triangular form, to be laid under the pans, and the cockell, which is an iron trunk, used to dry the goods in the stove; and also iron doors, stove-doors, and pan-doors, &c.

The carpenter raises the frame-vent over the pans, which is a hood of thin board, so formed as to conduct the flames to the two brick funnels, which are led up on either side of the pan-chimney to the top. He also furnishes the racks of the stove, a trough to convey the sugar from the pans to the cistern, and another to return it from the cistern to the pans, syrup-froths, blocks, cooler oars, &c.

The back-makers supply two or more tubs or backs for lime-water, which are round, oval, or square, and whose capacity varies from thirty to two hundred barrels. The high-chimney, is any vessel large enough to hold a considerable quantity of common water. The mould-cistern is a large oblong vessel, in which the moulds are foaked before they are used: it is usually about four feet fix inches deep, and should be capable of containing at once as many moulds as are used in one day’s refining.

The clay-cisterns are supplied either by the back-maker or carpenter, and also the clay-bar, which is made of oak or elm, its club end being flueck full of iron-points: its use is to macerate and fine the clay.

The wicker-work consists of refining-basket, clem-baskets, pulling-up baskets, coal and clay-baskets, &c.

The sugar-mill is one of the most simple machines of the kind: the runner is sometimes made of cast-iron and sometimes of stone: the former is preferable, because a larger diameter and a broader surface may be had with the same weight. The runner and the centre post should have a brafe collet within them, for the iron spindle to turn upon. The mill should stand on a solid foundation; either on the earth, or on the centre of a brick or stone arch. The veeels of pottery are of various sizes, and of two different forms and denominations, six, pots and moulds.

The construction of the pan-chimney requires peculiar attention; it should be placed on iron beds, and the horizontal bars on which it rests must be wrought in the walls of the building, and clenched down on the outside. But the setting of the pans is the most difficult work; for it is necessary that they should be so fixed, as that the flames, which
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which burn away under them three or four times in a year, should be taken out and replaced, without pulling down the whole work.

After all, a principal consideration in the construction of a sugar-house, is the obtaining a sufficient degree of heat. Various degrees of heat are required for different sorts of goods, and occasionally for the same sort: accordingly each floor may be made more or less warm, as the cafe requires. The heat is introduced through the pan-chimney, the stove-chimney, and sometimes through iron or brick flues raised on purpose. It is communicated from the chimneys by fluttering the register-plates; after the fires are extingushed, or when they are nearly out, and the remaining ashes are perfectly clear. After fluttering the register-plates, the small iron doors (one of which is fixed in the chimneys both of the cockell and the pans upon every floor) are opened, to convey heat where it is wanted.

Labourers in sugar-houses are very subject to dysenteries: the visnum animonis cercatum is an effectual remedy in these cafes.

Sugar-Mill, a machine used in the West Indies to press out the juice from the sugar-cane, as briefly described under our article Sugar, sapra. The sugar-mill is a very simple machine, consisting only of three vertical rollers mounted in a frame. The power is applied to the centre one to turn it round, and all the three are made to turn together by means of cog-wheels. The canes are introduced between these rollers, which as they turn round draw in the canes and give them a very violent pressure, which is sufficient to extract the juice and leave the canes dry.

Sugar-mills are worked by cattle, wind, or streams of water; and since the improved steam-engines of Mr. Watt have become general, many steam sugar-mills have been sent out to the West India plantations. In situations where a fall of water cannot be obtained, those are preferable to catttle-mills or wind-mills; for if cattle are used, an extra flock should be kept on purpose, because the regular cattle of the plantation are fully employed at the seafon of cutting the canes. The operations of the mill should be carried on constantly in a regular manner, until the whole crop is finished, or there will be danger of the juice fermenting in the canes, if the machinery is not sufficiently powerful to extract the juice from the canes as fast as they are brought in from the field in bundles. For this reason wind-mills are very objectionable, as no dependence can be placed upon them for fulfilling their allotted task in the required season. In many wind-millers levers are provided, to which mules or oxen can be harnessed, to work the mill when the wind fails, the machinery of the faiIs being then detached. But this expedient takes off the cattle from their regular field employment. A water-mill, or steam-engine, is free from these objections; and if it is sufficiently powerful, the whole produce of a plantation can be pressed, and the juice obtained ready for the boiling-house, in a short a time that the juice will be quite fresh. There are some water-mills in Jamaica, sufficiently powerful to grind as many canes in a week as will make thirty hogheads of sugar.

Plate Sugar-Mill contains two views of a sugar-mill to be worked by steam. K represents the axis of the crank of the steam-engine, and L the fly-wheel; I is a pinion, fixed upon the end of the axis K, and turning the large cog-wheel ZI, which is fastened upon the extremity of the horizontal shaft G, which supports the pivots of the two latter wheels, are built into a wall, which may be considered as the wall of the house in which the steam-engine is placed. At the opposite end of the horizontal shaft, G, is fixed the bevelled cog-wheel F, which gives motion to the horizontal bevelled wheel E, fixed upon the top of the axis, D, of the middle roller B. The other rollers, A and C, are placed on each side of it, and all three are made to turn round together by a cog-wheel, S S S, at the upper end of the rollers mounted in an iron frame, consisting of two horizontal frames, P P, Q Q, furnished by uprights O, O, and the openings of the frames P Q, contain the brafs bearings for the pivots of the three rollers, which brafs are adjustable by means of cros keys, and wedges driven through openings in the frames, so as to force the rollers towards each other, and retain them at a regular and invariable distance. The surfaces of the rollers are fluted, as is shown in the figure, with grooves of a small depth. These make the rollers take a firmer hold of the canes to draw them in, and also facilitate the running down of the juice from the canes into a pan or ciferon, which is formed round them at the lower part Q Q, by a plate of iron upon the frame Q, turned up all round at the sides; and at one end there is a spout, Q, to carry off the juice into a pipe, which leads to the boiling-house. This receptacle for the juice forms a small circular channel or gutter round the lower edge of each roller, to receive the juice which runs down the surface of the rollers; but a small raised rim is carried round the centre part or pivot of each roller, the edge of which is higher than the surface of the liquor in the pan, to prevent the juice flowing down into the bearings of the lower pivot. The weight of each roller, which is considerable, is supported in a brass step or bearing beneath the frame Q, as is shown by the dotted lines in fig. 1, and in some cases friction-rollers are applied beneath. The rollers are made of cast-iron, and hollow within; the external surfaces are truly turned.

The operation of the sugar-mill is extremely simple: the canes are made to pass twice under the pressure, first between the rollers B, C, and then between B and A. For this purpose, the negro who attends and feeds the machine, takes the canes in a handful, and applying their ends between the rollers B and C, the motion will draw the canes in between them, and they thus receive a first preasure. Another person, who stands behind the mill, and is called the returner, bends the ends of the canes as they come through, and holds them in contact with the surface of the centre roller B, so that it will carry them round by its motion, and introduce them again between the rollers A, B, where they will come out again in front, pressed dry from their juices. The second pair of rollers, A, B, are adjusted by the wedges of their bearings, so as to be rather nearer together than the first pair, because the canes are flattened and crushed by the first preasure between the rollers B, C, and require a still greater degree of preasure the second time. The space between the rollers is very small in either case, for the canes are of a very frit substance, and they are squeezed excessively hard in passing between them. In the most complete mills they employ what is called a dumb returner, instead of having a person behind the mill to return the canes. This is a circular piece of frame-work, or kind of screen, which is fixed fast to the frames P and Q, and is made to encompass the middle roller at the back. It receives the canes as they come through the first time, and holds them in contact with the middle roller, till the ends return between the other pair of rollers. It effects this much more completely than the most active of returners can do. The canes which have passed through the mill are squeezed completely dry, and are sometimes even reduced to powder. This refuse is called cane-trash, and is used as fuel in the boiling-house.

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Sugar-mills were formerly made of wood in the framing, and the rollers were made of hard wood; afterwards they were covered with an iron cladding. The belt mills are now made wholly of iron, which is a better material, because it will not suffer the rollers to yield, and the canes which are presented cannot escape the full force of the pre累累 to which it is intended to subject them. When the sugar-mill is turned by cattle, the axis, D, of the middle roller has a long lever, E, and cross rod, F, in place of the wheel E: the arms of the lever extend on each side at least eighteen feet from the centre for the cattle to draw from; and to render the arms firm, the axis L is carried up to a considerable height above E, and oblique braces of wood are extended from the extremities of each of the arms, by which the horses or mules draw, to the top of the vertical axis, thus forming a triangle. Two mules are harnessed to each arm for the common small mills; but for a mill such as is represented in the drawing, four arms must be provided, to admit of six or eight mules to turn it.

Some sugar-mills have been made within these few years of an improved structure: the rollers are placed horizontally, and the centres of the three are arranged in a triangle, two rollers being below and one above them, so that the upper roller, to which the power is applied, touches the other two: in fact it rests upon them, and the returner is rendered unnecessary, because the two lower rollers are so near together, that the canes pass from one to the other. This is not a new invention, as we find a drawing of it in Mr. Smellie's MS. papers entitled "sugar-mill, designed for Mr. Grey in 1754," and sent by him to Jamaica, but not then executed." This mill, which is on a large scale, and has two sets of rollers, is worked by an over-shot water-wheel, the axis of which forms the upper of the three rollers at each end, and is for that purpose caged with a cylinder of iron: the other two rollers at each end of the wheel are placed beneath the axis, so that it will rest upon them. The upper roller, therefore, answers to the middle roller of the common sugar-mill, and the two lower ones to the outside rollers; but the centres being arranged in a triangle, instead of a straight line, the two outside rollers are brought as near together as they can be to touch, which must not be, because their surfaces move in opposite directions. The two lower rollers are contained in a small cistern, which is to receive the juice; and if the level of the water-wheel renders this cistern too low for the juice to run off to the boiling-house, a small pump is applied to lift it into a proper trough. This pump is worked by a lever and a pin, projecting from the shaft of the water-wheel. The two lower rollers are turned round by means of a cog-wheel upon the end of each, working in cog-wheels upon the axis of the water-wheel and upper roller; but it is necessary to have two separate cog-wheels upon this axis, because as the two lower rollers are placed so near together, the cogs of their wheels would touch; and as this cannot be, because the adjacent surfaces of the two lower rollers must move in contrary directions, the cog-wheels upon the two lower rollers are therefore placed in different planes, so that they will fall side by side, and will not meet each other. The teeth of the cog-wheel upon the upper roller or axis of the water-wheel is made of double breadth, or has two separate rings of cogs, one giving motion to each of the rollers. By this means the three rollers are all turned round in the same direction, as in the common vertical mill. This occasions the two adjacent fides of the two lower rollers to move in contrary directions.

The advantages of placing the rollers horizontal are considerable. The weight of the water-wheel, as well as its power of rotation, tend to keep down the upper roller upon its work. The feeding of the mill is rendered much more regular and easy, and the canes are returned through a second pre累累, without the aid of the returner.

For the convenience of feeding the mill, a board or bench is placed in a sloping direction, leading to the space between the first of the lower rollers and the upper roller: upon this bench the canes are spread in a regular and even layer, which is pushed forwards and backwards, and other canes are introduced between the rollers, in the same manner as a threshing-mill is supplied. The canes as they pass through are prised against the surface of the back lower roller, because the space between the two is not sufficient for the canes to fall through; and the motion of the back roller raises up the canes, and introduces them between the back roller and the upper roller. This second pre累累 deprives the canes of all their juices, and they are received on an inclined board, which slopes from the rollers sufficiently to carry down the cane-trafi into a heap, from which it can occasionally be carried away. A mill of this kind will do much more work than a vertical mill, for the negro must lose time in feeding the canes between the vertical rolls, because he can only present as many as he can hold between his hands; but with a horizontal feeding board he spreads out a sufficient quantity of canes, and by pushing them forwards, presents them to the mill as fast as it will take them in, and that at the same time without choking, because he can arrange them in a layer. There is no advantage in placing the rollers vertically, which was originally done only with a view of making the most convenient application of the power of the water. When a water-wheel is used, or a steam-engine, the horizontal rolls are the most convenient as well as the most effective. When a water-wheel is applied to turn the common sugar-mill, the wheel, E, at the top of the axis of the middle roller, is made twice or three times as large as represented in the figure, and its teeth downwards; then a wheel, similar to the wheel F, gives it motion; this latter wheel is fixed upon the end of the axis of the water-wheel, but it is then placed beneath the wheel E, instead of above it.

Sugar, in Agriculture, is a material that is found to be present in many substances which are employed as the food of domestic animals, and upon which their power of nourishing and rendering them fat, in a great measure, depends. It is ascertained to exist, in a pretty large proportion, in a great number of plants and substances that are used in this way; and its feeding or fattening properties in such cases have lately been put to the test and more fully proved, in consequence of the markets of this country having been so much overstocked with this substance in its prepared state, from our possessions in the West Indies. Various hints, proposals, and attempts, for bringing it into use in this intention, have been made; and different limited trials have fully decided that it is capable of being employed for this purpose with success; but hitherto the want of proper regulations in regard to the duties that have been laid upon it in this country, have put a bar to any considerable trials or undertakings in this way. Most forts of the above description of animals are fond of this substance, as well as the other matters which contain it; and it is found to support and keep them in condition in an equal manner to most kinds of grain, or other matter of that kind; but from the smallness of the quantity employed, some sort of deft material is constantly necessary, such as hay, cut straw, chaff, or some other similar bulky substance, in order to fill and digest the stomach in a proper manner. See SACCHARINE Matter.

It is observed on the same authority, that besides the crystallized
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crystallized and solid sugars, there appears to be a fugar which cannot be separated from water, and which exists only in a fluid form; and that it is this which constitutes a principal part of melasses or treacle, which has also been employed with success in fattening animals of the cattle kinds, in mixture with some sort of diffusing substaninces. See SROLL—SROLLING, and TREACLE.

SUGAR, in Chemistry and Medicine, denotes a crystallizable effuential salt, of a sweet agreeable taste, contained more or less plentifully in many kinds of vegetables, as well as in the fugar-cane, which furnishes the greatest quantity of it.

Sugar, according to the experimental trials of some, contains carbon, oxygen, and hydrogen, nearly in the proportions of three of the first, four of the second, and eight of the last. And the estimates of others give the same elementary parts, as in substances of the gum kind; as eleven of carbon, ten of oxygen, and twenty of hydrogen.

M. Marggraf has obtained fugar from the roots of several plants, as from carrots, parsnips, white and red beets. Among all the vegetables indigenous to the middle and north of Europe, which are fermentable saccharine, the beet-root is found to exceed them all in the quantity of fugar which it contains: this was ascertained by M. Marggraf, in his experiments for discovering some native fugar that might serve as a substitute for foreign fugar. (Mem. de l'Acad. de Berlin, for 1747.) See BERTA. Two methods were pursued by this accurate chemist. One was to dry a given portion of the vegetable, to boil it in rectified alcohol, and then keep the alcoholic solution at rest for a time, by which the fugar will separate in crystalline grains. This mode, however, is much too expensive to be pursued in manufacture, but it serves as an useful indication of the comparative proportions of fugar in different vegetables, though the actual quantity obtainable by the usual mode of manufacture appears to fall far short of what is yielded by treatment with alcohol.

The other method was to imitate in the small way the process performed on the fugar-cane juice, which also was attended with a certain degree of success. The experiments of this celebrated chemist are the following: three roots were selected, the white beet, the red beet, and the skirret, all of which gave evident indications of abounding in fugar, for when cut in slices, and dried, their taste is very sweet, and the microscope shews a number of crystalline grains of fugar dispersed through their substance.

Some slices of white beet thoroughly dried, but not burnt, were powdered coarsely, and 8 oz. of this powder, again dried, were put into a bottle with 16 oz. of highly rectified alcohol, and being loosely stopped, the liquor was slowly brought to boil on a sand-bath, with frequent shaking. The vessel was then removed, the solution filtered, and the powder pressed strongly, to squeeze out all the liquor. This clear solution was then put into a bottle which was corked, and set by in a cool place. A crystallized salt deposited gradually in the course of some weeks, which was hard and tolerably pure fugar. This was redissolved and again crystallized in the same way, by which a very pure fugar was obtained. In this way, 8 oz. of the white beet-root gave half an ounce, or ½ of fugar; 8 oz. of skirret-root, equally dried, gave 3 drachms, or about ½ of fugar; and the same quantity of the red beet gave only 2½ drachms, or about ½ of fugar. The solution, however, still contained a quantity of fugar mixed with the refined part of the root, and if it is evaporated to dryness, a sweetish uncrystalized extract remains.

The skirret-root was then treated in the following man-

ner without alcohol, with a view of extracting the fugar. A quantity of it was chopped small, bruised in a mortar, and the juice expressed through a cloth bag, and the pulp was again moistened with water, and expressed, to get out all the saccharine liquor. The whole liquor was then kept at rest for 48 hours in a tortilla collar, by which most of the feculence subsided, and the clear liquor was carefully drawn off. The author lays much stress on this part of the process, which, if it is not done properly, considerably hinders the subsequent production of the fugar. The clear liquor was then heated in a copper pan, clarified with white of egg, and boiled down to the constipate of thick syrup, and kept in this state for about six months in a warm place, by which it concreted into a semi-fluid crystalline mass, composed of impure crystals of fugar and a good deal of syrup. The whole mass was then a little warmed, to give the syrup a little more fluidity, and poured into a funnel-shaped vessel of tinued iron, with holes at the sides and bottom, and let by in a warm place; by which, after a considerable time, the impure uncoagulable syrup slowly filtered to the bottom, leaving the purer saccharine part in the form of a brown granular mass. The latter was then re-dissolved in water, again clarified with white of egg, strained, boiled with a little lime, again strained, and then evaporated to a thick consistence, and stirred till cold. A fugar yield not quite pure than the last was thus obtained, which, on being kept for a week in a funnel-shaped pot, with a single hole at bottom, plugged up, congealed into a grained fugar equal to good mufcovado, from which a syrup separated and dropped through when the plug was withdrawn.

Such is the process of this chemist to obtain a fugar from the skirret-root, and he proceeded in the same manner with the white and red beet-root, and with the same success. He further observes, that he rinsed the beet-roots, being harder than the skirret; that the mucilaginous deposit from the beets was browner and less copious than from the skirret; the fugar from the white beet was the most abundant and the purest, and that from the red beet was the least so. The mucilage or sediment from the skirret, washed with cold water and purified, yielded a very good white farina.

All these roots are very watery. The white beet loses by gentle, but entire, defecation, full three-quarters of its weight, and the red beet seven-eighths.

For an account of the experiments of Achard, and other chemists, see BERTA.

It is also presumed, that much fugar may be obtained from other vegetables, as from green peas, cabbage, green farinaceous grains, as barley, (see MALT,) ripe fruit of grape, date, and fig, and the root of parsnip, &c. and from several trees, as the fycamore and birch trees. Green maize (see MAIZE) contains a liquor from which the American fayages are paid to extract fugar. It may also be extracted from the asclepias cand e r E T E F E C T I C A C N I E N N O N, and from any flowers collected while the morning dew is upon them. But the vegetable which yields the largest quantity of fugar, next to the fugar-cane, is the fugar-maple. (See MAPLE.) The methods employed for extracting fugar from this tree in Canada are related by M. Gautier, in the Memoirs des Scav. Etrang., tom. ii. and by M. Kalm, in the Swedish Mem. for 1757. (See MAPLE Sugar.) The season for tapping the tree is from February to April, for about six weeks, during which time a tree of moderate size will yield from 20 to 30 gallons of sap, from which may be made about five or six pounds of pretty good fugar. The tree does not seem to sustain any injury from this operation, for the juice is more savoury from the trees that have been
been already tapped, than from those that are fresh. This juice, which is clear, and of a pleasant taste, is made into fugar by the farmers in the country, with a simple apparatus. It is usually clarified with lime and white of egg (or milk) boiled down, grained, and clayed, like the canec-juice. Sometimes the quantity of liquid is reduced by freezing at the proper season, which is preferred to evaporation. This substance might, it is supposed, be made into loaf-fugar, as well as the framec-juice. It is commonly kept in a half-purified state, like the common moist fugar. The juice will also furnish a pleasant wine by fermentation, and a good vinegar.

By discovering a menstrum that would dissolve the fugar, and not the slimy substance, the saccharine and mucilaginous parts of plants might be separated from one another with advantage. Sugar is scarcely, if at all, contained in any part of the animal kingdom, (honey certainly belonging to the vegetable,) except in milk, and in the urine, during the singular disease called "diabetes mellitus."

Pure fugar appears either in a regularly crystallized form, or in thinning white crystallized grains. Both in candy and loaf it is hard and brittle, inodorous and sweet. If hard loaf-fugar be rubbed in the dark, it is very luminous. With the nitric acid it is convertible chiefly into the oxalic acid. It is very soluble both in water and alcohol. Mafles, which are constituted chiefly of the uncrytallisizable parts of the juice of the fugar-cane, and which Prouit has denominated liquid fugar, are more soluble in alcohol than fugar. Sugar requires only its own weight of water at 49° for its solution; and when united at a higher temperature with a smaller quantity, it remains dissoled and forms a syrup. The watery solution, mixed with mucilaginous, farinaceous, or other matters, readily enters into the vinous fermentation; whence it is inferred, by considering that the strength of the liquor and quantity of alcohol produced depend on the quantity of fugar, that the most essential part of the process of vinous fermentation is the conversion of fugar into alcohol. Four parts of boiling alcohol dissolve one part of fugar; but a moiety of fugar again separates by reft in crystals. Oils readily combine with fugar, and the mixture is miscible with water. Lime and the fixed alkalies unite with fugar, and form compounds, without any sweet taste. The concentrated strong acids dissolve and decompose fugar, but the weaker simply dissolve it; and the alkaline and earthy hydro-sulphurte, sulphures, and phosphures, decompose it, and resolve it into a vitrifica resembling gum. Its ultimate constituent parts, according to Lavosier, are 64 of oxygen, 38 of carbon, and 8 of hydrogen, in 100 parts.

Sugar melts at a heat considerably above that of boiling water, and forms a blood-red viscid fluid, which, cooked, has a flavour of emperyums, not ungrateful, mixed with the natural sweetness. When melted, it takes fire from a lighted substance, and burns with a strong flame, and a penetrating odour, which excites coughing, and is owing to the production of an acid.

If fugar be distilled per se from a glass retort with a heat gradually increased to redness, and the proddebs be carefully collected, they will be found to be, first, a coloured liquor, strongly acid and punget, called the "pyromucous." A large quantity of gas comes over at the same time, which is hydro-carbonat mixed with a little carbonic acid; and a very pure charcoal is left behind, which burns away in the open air without leaving any residue. Neither azot, ammonia, nor lime, nor any other substance, is obtained in this process, whence it appears that fugar is one of the purest hydro-carbonous oxydes known.

SUGAR.

The actual chemical differences between mucilage and fugar, as stated by Mr. Cruikshank, are the following: fugar is soluble both in water and alcohol, and crystallizable from either solution; but mucilage is insoluble in alcohol, and refuses to crystallize from its watery solution: 480 grains of fugar yielded by distillation 130 grains of charcoal, 270 grains of liquid pyromucous acid, 41 ounce-measures of carbonic acid gas, and 119 ounce-measures of hydro-carbonat gas. The same quantity of gum arabic yields 75 grains of charcoal, 210 grains of pyromucous acid, 95 ounce-measures of carbonic acid, and 180 of hydro-carbonat. It also gave about 10 grains of lime, and the acid, when saturated with lime, gave out a little ammonia; and hence it appears, that linde and azot are substances that belong to mucilage, and not to fugar. The habitus of each substance with nitric acid differ also considerably. When gum arabic (e. g.) is heated with nitric acid only till nitrous gas begins to be digested, a quantity of white insoluble matter precipitates, which is the "mucous" acid, and the residue is "malic" acid, which a farther addition of the nitric converts into oxalic. But fugar is changed into oxalic, or malic and oxalic acid, without the production of any mucous acid. The quantity of oxalic acid produced from a given weight of fugar with nitric acid also exceeds that yielded by the same weight of mucilage with the same proportion of acid. In the spontaneous changes, also, fugar and mucilage differ essentially: fugar being the essential material of the vinous fermentation; but mucilage is incapable of this process, when pure, and appears to contribute little to the generation of alcohol, when in combination with fermenting materials.

From the known properties of fugar, it is supposed to unite the unctuous part of the food with the animal juices; hence some have concluded, that it is nutritive to animals, and increaseth copulence; others have ascribed to it a contrary effect, as it is said to prevent the separation of the oily matter, which forms fat, from the blood; and others, again, have charged it with rendering the juices thicker and more sluggish, retarding circulation, obstructing the natural secretions, and thus occasioning or aggravating scrofulatic, cathartic, hypochoonidrical, and other disorders. However, experience seems to shew, that the moderate use of it is at least innocent.

Professor Murray, who has treated this subject very elaborately, thinks that by the fermentation which fugar undergoes in the stomach, and by its relaxing salutary faponaceous qualities, as well as by the acid which it contains, it rather tends to emaciate than to fatten the body; and in this opinion he observes that he has the authority of Borehove, who says, if this sweet be taken in large quantities it produces emaciation, by disolving too much of the animal oil. He is therefore much furthered, that Mr. John Hunter should lately recommend fugar and honey as the best restoratives to those suffering from great debility by a long course of mercury. What may be the effects of fugar in this respect in its refined state may be difficult to determine; but in its crude state there can be no doubt of its affording a considerable share of nourishment, both as combined in various vegetable matters, and as separated by art. Those animals which wholly feed upon it in the fugar islands, become remarkably corpulent; and the negro children, whose diet happens sometimes for a season to be confined to mafles, are easily distinguished from others by their superior bulk; they are, however, more disposed to suffer from worms, and are likewise less active and healthy.

Sugar however appears, by the experiments of several writers, to prove deleterious to various kinds of worms, either
either by immersing them in a solution of sugar, or sprinkling it upon their bodies; and twenty grains of lump-sugar forced into the stomach of a frog, produced immediate torpor and death, which followed in the course of an hour; it also proved fatal to pigeons, and to the galline kind, but not to sparrows; and with sheep and dogs it had no other effect than that of a cathartic.

Sugar may certainly be taken into the stomach in pretty large quantities, without producing any bad consequences; though proofs are not wanting of its miscible effects, in which, by its attenuating and dissolving the fluids, and relaxing the Bowels, debility and Difease are said to have been produced. Stark for many days took from four ounces of sugar, to eight, ten, fifteen, and even twenty, with bread and water, by which naufca, Satus, ulceration in the mouth, with redness and tumefaction of the gums, oppression, purging, pain, and redness of the right nostril, bleeding at the nose, and livid fleas over the right scapula, were produced. We are told that a boy, who was much affected by acidity of the stomach, in a short time greedily ate a large quantity of lump-sugar; soon afterwards he was taken ill, and the next morning found dead in his bed. Upon examining his body, red spots, and other marks of a diffused state of the blood, were discovered. What degree of credit ought to be given to these and other tales of the like kind, we leave to the judgment of our readers; but that the liberal use of sugar to many stomachs has greatly impaired the digestive powers, and laid a foundation for various complaints, is highly probable. At the same time we must admit, that several indulge largely in this article, if not with advantage, at least with impunity.

As a medicine, sugar cannot be considered to possess much power. Dr. Cullen classes it with the attenuantia; and Bergius states it to be febrifuge, ediscurans, relaxans, pecfortalis, vulneraria, antifeptica, nutrimens. In catacular affections, both sugar and honey are frequently employed; it has also been advantageously used in calculous complaints; and from its know power in preserving animal and vegetable substances from putrefaction, it has been given with a view to its antifeptic effects. The candy, by dissolving slowly in the mouth, is well suited to relieve tickling coughs and hoarseness. The use of sugar in various medical compositions is too obvious to require being particularly pointed out.

Raw sugar and maflasses, by virtue of their oily or treacly matter, prove emollient and gently laxative. The crystals or candy are most difficult of solution, and hence are most proper where this soft lubricating sweet is wanted to dissolve slowly in the mouth, as in tickling coughs and hoarseness. Refined sugar, externally applied, is elciharotic.

Coarse sugar, in which there is more oil than in refined sugar, is recommended as a good medicine in collyria for discharging ulcers of the cornea, in which affringents are hurtful. Aikin. Lewis. Woodville.

Sugar, Acid of. See Oxalic Acid.

Sugar, Empergeromastic Acid of. See Sugar, jupra, and Pyromusius Acid.

Sugar, Caff or Cheese of. See Cask and Chest.

Sugar of Lead. See Lead, and Saccharum Saturni.

Sugar, Maple. See Acer, Maple Sugar, and Sugar maple.

Sugar of Milk. See Milk.

Sugar of Raff, succharum refatum, is white sugar clarified, and boiled into a confection in rofe-water; when boiled, they form it into lozenges, sometimes into little grains, of the fize of peas, by keeping it furring till it be cold and dry. It is reputed good to soften and alay scrofulous, &c. of the breast. See Rose.

Sugar. Spirit, a name given by our distillers to a spirit made in England, Holland, and other places, from the washings, fermentations, drofts, and waife of a fugar-baker's refining-house. The manner of preparing it is the fame with that ufed for the malt and maflasses spirts. The refue of the fugar is fermented with water in the ufual manner, then distilled into what is called low wines, and afterwards rectified, without any addition, into proof-spirit.

When the operation is well performed, and no foul, fetid, or foreign matter has got in among the wash, this is a tolerably clean spirit. We commonly make it thus, but in Holland it is ufually made very yellow and difagreeable; though capable, by an easy rectification, familiar with us, but not much known abroad, of being brought to a fine and clean spirit. With us this sugar-spirit is ufed to mix with, and adulterate brandy, rum, and arrack, which will receive a large dofe of it without its being at all difcoverable; but the Dutch, who have it very coarse, can only adulterate rum with it, and even that will bear but a small proportion, without being betrayed by its nauseousness.

This sugar-spirit, reduced to alcohol, makes one of the purest spirits we are acquainted with, much superior to that of maflasses, and much more to that of malt. Shaw's Essay on Distillery.

We have in the Philosophical Transactions, an account of a volatile and pungent spirit of sugar, which was made from what the fugar-bakers call sugar-water; which is so other than the water in which the aprons, moulds, and other utensils, employed in the refining of sugar, are washed. This was fo extremely pungent, that a man could not smell to a large quantity of it without danger of suffocation; and fo volatile, that no Ropping it would preserve its spirit for any length of time. Phil. Trans. No 130.

Sugar Scum, in Agriculture, the surface scummy material which is taken off from the boilers of the fugar-bakers, and which in some places is made considerable use of as a manure. It consists principally, according to Sir H. Davy, of bullock's blood, which has been employed for the purpose of separating the impurities of common brown sugar, by means of the coagulation of its albuminous matter by the heat of the boiler. It is of course of an animal nature, and must be most useful on lands in which there are subfiances of the muddy kind, on which it can readily operate and produce a beneficial effect.

Sugar, in Geography, a river of Veragua, which discharges itself into the bay of Honduras.—Allo, a river of America, which runs into Saganaun bay.—Allo, a river of New Hampshire, which runs from the Sunnapee lake into the Connecticut.

Sugar Creek, a river of Pennsylvania, which runs into the E. branch of the Susquehanna, N. lat. 41° 21'. W. long. 76° 3'.—Allo, a township of Armbrong county, in Pennsylvania; containing 1113 inhabitants.—Allo, a township of Venango county, in Pennsylvania; containing 461 inhabitants.—Allo, a township of Greene county, in the district of Ohio; containing 1386 inhabitants.

Sugar Hill, a rugged eminence in the state of New York, near Ticonderoga, which was taken possession of by general Burgoyne, when he compelled the Americans to abandon Ticonderoga.

Sugar Leaf, a mountain of the island of Cuba; 35 miles N.E. of St. Jago.—Allo, a mountain of the island of Ceylon; 52 miles N.E. of Candy.—Allo, a mountain in the island of St. Jago, 8 miles S.E. of...
of Aynt Point.—Alfo, a small island in the East Indian Sea, near the coast of the island of Flores. N. lat. 9° 59'.
E. long. 120° 47'.—Alfo, a cape on the coast of Africa.
S. lat. 12° 4'.—Alfo, a small island in the Mergui Archipelago.
N. lat. 10° 43'.
SUGAR-Leaf Bay, a bay on the N.E. coast of the island of Juan Fernandez.
SUGAR-Leaf Hill, an eminence, serving as a landmark, on the N. coast of land Erin.
SUGAR-Leaf Mountains, mountains of Ireland, in the county of Wicklow, near the sea-coast; 10 miles N. of Wicklow.
SUGAR-Leaf Islands, a cluster of small islands near the W. coast of New Zealand, N. of Sugar-leaf Point.
SUGAR-Leaf Point, a cape on the W. coast of Eheimomauhee, the northern island of New Zealand.
S. lat. 29° 3'.
W. long. 185° 8'.
SUGENHEIM, a town of Germany, belonging to the marginve of Anpach, insulated by the bishopric of Bamberg; 20 miles N. of Anpfacht. N. lat. 45° 4' E.
long. 10° 31'.
SUGER, in Biography, abbot of St. Denis, and prime minister of France under Louis the Young, was born in the year 1082. He was employed by Louis le Gros, who conferred on him the abbey of St. Denis, and employed him in a variety of concerns of a very different nature from those of his ecclesiastical appointment, so that he adopted the manners and appearance of a statesman, more than those of an abbot. At length, by the exhortations of St. Bernard, he determined to reform both his monastery and his own conduct. Accordingly he had resolved on confining himself to his cloister, when Louis the Young, successor to Louis le Gros, setting out on a crusade to the Holy Land in 1147, nominated Suger regent of the kingdom. In this high station he acted with wisdom and integrity, and adopted measures for supplying the king with money, without burdening his subjects. After the king's return he continued to place confidence in Suger, who prevailed with him not to divorce his queen Eleanor of Guinevere; but unfortunately for the kingdom, this great minister died in 1152, at the age of 70. He was magnificently interred at St. Denis, the monks expressing a due sense of his fame, by merely inscribing on his tomb the words, "Here lies the abbot Suger." His works were a "Life of Louis le Gros," "Memoirs of his Administration at the Abbey of St. Denis," &c. "Epitaphs," &c. which Du Chene has published in the collection of French historians. Moreri.
SUGGESTION, Suggestio, the act of hinting, or furnishing another with a thought or design, or of intimating it artfully into his mind.
In the French law, a testament is said to be made by suggestion, when it is made by surprize, and contrary to the intention of the testator.
If suggestion be proved, the testament becomes null. Articles of suggestion are not admissible against a testament written with the testator's own hand, which is never suspected.
SUGGESTION for Prohibition, in Law. See Prohibition.
SUGGESTION, Prosecution by Information or. See Information.
SUGGESTUS, among the Romans, a place in the Campus Martius raised higher than the rest, where every magistrate, according to his rank, was allowed to harangue the people; but private persons could not, unless they first obtained leave from some magistrate to do it.
SUGGUNDARIUM, among the Romans, a place where infants, not exceeding forty days old, were buried; it being unlawful to burn them.
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SUGHUD BAZAN, in Geography, a large harbour on the W. coast of Mindanao. N. lat. 6° 5'.
SUGHUD, a town of Asiatic Turkey, in Natalia; 4 miles E.S.E. of Inkik.
SUGILLATION, in Surgery, an ecchymosis; which fee.
SUGITIVA, a term used by some authors to express medicines whichuck up and absorb the ferments in topical phorons.
SUGOLLY, in Geography, a town of Hindoostan, in Bahar; 10 miles E.S.E. of Bettiahs. N. lat. 25° 45'.
E. long. 82° 44'.
SUGUD. See Pollock.
SUGULMESSA, Sigidemessa, or Segulmesa, a town of Africa, in the empire of Morocco, the capital of a district, and at one time the capital of a kingdom to which it gave name, now called "Taflet" which fee. This town seems to have been known to the Romans; and we learn from Leo Africanus, that it was anciently called "Meeta," i.e. Victory; and that a Roman general, having there followed and vanquished the Numidians, restored the town, and gave it the name of "Sigillum Mesiae," i.e. the Seal of Victory, from which was derived Sugulmesa; 72 miles E. of Taflet. N. lat. 31° 26'.
W. long. 9° 18'.
SUHLS, a town of Germany, in the county of Henneberg, on the Hasel; in which are manufactures of reed, fustians, and ticks; 7 miles S.E. of Smalkalden. N. lat. 50° 40'.
E. long. 10° 58'.
SUHLINGEN, a town of Germany, in the county of Hoya; 15 miles S.W. of Hoya.—Alfo, a river of Germany, which runs into the Aue, 5 miles S. of Bahrenburg, in the county of Hoya.
SUKHANDROS, mountains of Asia; 30 miles S.S.E. of Candahar.
SUKALPOOR, a town of Hindoostan, in Malwa; 40 miles N.E. of Indore.
SUKANAGUR, a town of Bengal; 36 miles S.S.E. of Nattore.
SUKANHEE, a town of Hindoostan, in Orissa; 36 miles S.W. of Balafore.
SUVATA, a cape of Russia, in the Frozen ocean. N. lat. 69° 40'.
E. long. 46° 34'.
SWIVATOR, a cape of Russia, on the coast of the Frozen Sea. N. lat. 68° 30'.
E. long. 49° 30'.
SUJATPOUR, a town of Hindoostan, in Bengal; 62 miles N.E. of Dacca. N. lat. 24° 20'.
E. long. 91° 30'.—Alfo, a town of Hindoostan, in Rohilcund; 35 miles S. of Pillibeat.
SVIBOVETY, a town of Croatia; 40 miles E. of Agram.
SUIERUS, (Schweitzer,) John Caspar, in Biography, a learned divinity, was born in Switzerland in 1619, studied divinity at Saumur and Montauban, and became professor of sacred literature at Zurich. His study of the Greek fathers produced several works, the principal of which cost him 20 years' labour, and was entitled "Thefaurus Ecclesiasticus, e Patribus Graecis, ordine Alphabetico exhibens quaequeFragmenta, Ritus, Dogmata, Heresies, et hujusmodi alia humanae," Amst. 2 vols. fol.; and in a much enlarged edition, Amst. 1758. Among his other works were "Observations Sacros," Tigrur. 1665; 4to, and "Miscellanea," containing several extracts of the Greek fathers, with a Latin version, Tigrur. 1681, and a "Greek and Latin Lexicon." Moreri.
His son, Henry Suierius, was also a professor at Zurich and at Heidelberg, and the author of some literary works. He died in 1705, the same year with his father.
SUCIDE, in a general sense, and according to the etymo-logy
SUICIDE.

logy of the term, derived from s and cedo, is self-murder. The only question in the argument concerning this subject, says archdeacon Paley, is no other than this,—May every man who pleases to destroy his life, innocently do so? Shall we say, that we are then only at liberty to commit suicide, when we find our continuance in life become uuelefs to mankind? Any man may, if he pleases, render himself uuelefs; and perfous of a melancholy disposition are prone to regard themselves as uuelefs, when this in the judgment of others is not actually the case. But if a law were promulgated, allowing any person to destroy another, when he judged him to be uuelefs, would not the latitude of such a rule be universally condemned? And would it not amount to a permission to commit murder at pleasure? A similar rule, regulating the right to dispose of our own lives, would be capable of the same extension. Besides, no one can be pronounced uuelefs, for the purpose of this plea, who has not lost every capacity and opportunity of being useful, and also the possibility of recovering either; and this supposes a state of such complete destitution and despair, as cannot be predicated, it is presumed, of any man living. Shall it be said, that it is only lawful for those who leave none to lament their death, to depart voluntarily out of life? Here it should be considered, not whether there are any to feel sorrow for us, but whether their sorrow for our death will exceed that which we should suffer by continuing to live? In this view of the question, the judgment that is formed will depend on much of the state of the spirits, or the pressure of any present anxiety, as to very little in hypochondriacal constitutions from an unqualified licence to commit suicide, whenever the diffidences fancied or feared, or actually endured, rose high enough to overcome the pain and dread of death.

Men are never tempted to destroy themselves, uuelefs they are oppressed by some grievous uneasinesses; and to these cases the restriction of the rule ought to apply. But what effect can we look for from a rule, which proposes to weigh our own pain against that of another; the misery that is felt, against that which is merely conceived; and in such an insufficient balance as the party’s own deterred imagination? Any other rule that can be assigned will ultimately bring us to an indiscriminate toleration of suicide, in all cases that involve the danger of its being committed.

It therefore becomes a subject of inquiry, what would be the effects of such a toleration? They must evidently be the loss of many lives to the community, of which some might be useful or important; the affliction of many families, and the confusion of all; for mankind must live in continual alarm for the fate of their friends and dear relatives, when the restraints of religion and morality are withdrawn; when every difficulty, which is powerful enough to tempt men to suicide, shall be deemed sufficient to justify it; and when the follies and vices, as well as the inevitable calamities of human life, so often make existence a burden.

A second consideration, and perfectly distinct from the former, is this. By continuing in the world, and in the exercise of those virtues which remain within our power, we retain the opportunity of mitigating our condition in a future state. This argument, it is true, does not stand, in a case where uuelefs prove suicide to be a crime; but if it supply a motive to dissuade us from committing it, it amounts to much the same thing. Now there is no condition in human life which is not capable of some virtue, active or passive. Even pietty and resignation under the sufferings to which we are called, testify a virtue and acquiescence in the divine counsels more acceptable, perhaps, than the most prostrate devotion; afford an edifying example to all who observe them, and may hope for a recompense among the moit arduous of human virtues. These qualities are always in the power of the miserable; indeed of none but the miserable.

Besides the general reasons already stated, and applicable to all cases of suicide, each case has some aggravations peculiar to itself; such as the duties that are deserted; the claims that are defrauded; the (obra, affliction, or disgrace which our death, or the manner of it, causes to our family or friends; the occasion thus given to many for suspecting the sincerity of our moral and religious professions, and those of all others, as well as our own; the reproach we entail upon our order, calling, or sect, &c. &c. Here we might add, that suicide implies a want of reverence for God, and renunciation to his will, who has assigned to every man his part in life to be maintained till the Lord of life and death disposes him from it; that it argues a dishonourable weakness of mind, want of fortitude, in not being able to endure the calamities of life; and the want of a due regard to that future state of existence to which the person chargeable with suicide passes by an act displeasing to God, and admitting of no repentance.

Should it be said, that we do not come into life by our own consent, as a follower does into an army, the answer is obvious, that God, as our creator and the preserver of life, has a much greater right to our humble obedience, than a general can have to that of a follower, how willingly soever he may have enlisted himself into his service. If we consult Scripture in reference to this subject, we find there the same general principles, that may, by construction and implication, be applicable to this subject. Here we find, in a variety of passages, that human life is represented as a term assigned or preferred to us; and, therefore, we are not at liberty to determine for ourselves the duration of our lives. We learn also that Christ and his apostles inculcate upon their followers, both by doctrine and example, no virtue so frequently and so earnestly as patience under affliction; and that the conduct of the apostles, and of the Christians of the apostolical age, affords no obscure intimation of their sentiments upon this point. In this world they experienced every extremity of outward injury and distress; and the change which death brought with it was, in their expectation, infinitely beneficial. Yet it never entered into their minds to hasten this change by an act of suicide; and this affords a very strong presumption that they apprehended some unlawfulness in the expedient.

In defence of suicide, many arguments have been urged, and particularly this following; that if we deny to the individual a right over his own life, it seems impossible to reconcile with the law of nature that right which the state claims and exercises over the lives of its subjects, when it ordains or inflicts capital punishments. It is also said that it will be equally difficult to account for the power of the state to commit its subjects to the dangers of war, and to expose their lives without scruple in the field of battle. This reasoning we observe, is founded on an erroneous principle, viz. that the state acquires its right over the life of the subject from his own consent; but the truth is, that the state derives this right, neither from the consent of the subject, nor through the medium of that consent, but immediately from the donation of the Deity.

No writer has discussed the subject of suicide more amply than Mad. de Stael, in her “Reflections sur le Suicide,” printed at London in 1819. Although it must be admitted that every act by which a man voluntarily causes his own death is not criminal, yet all such acts are suicide. Circumstances occur in which it is a duty to perform acts of which a man’s own death is the necessary result. This is the
the cafe in all the operations of war. Besides these suicides of duty, there are other cases of the hazard or sacrifice of life, which are considered as acts of virtue, requiring singular magnanimity, and justly distinguished by the most splendid reputation. Codrus and Decius present themselves to the recollection of every reader. Volunteers for the most perilous services are easily found; such are mounting a battery, or boarding a ship. They are arraigned on a charge of superstition, their death being neither demanded by duty, or performed for the preservation of a community or an individual, are yet generally considered as acts which, whether they be strictly moral or not, can only be performed by minds of the most magnanimous virtue. The suicide of Cato is of this kind. The merit of Regulus's return to Carthage was enhanced, in the opinion of one of the most sensible and moderate of moralists, principally by his certain knowledge of the death which his barbarous tormentors had prepared for him. Every cafe in which a man prefers death to guilt is a suicide of duty. Of this nature is all martyrdom, where life is to be saved only by false pretensions, or by compliances which the conscience of the martyr deems still more criminal. Among the early Christians there prevailed a fort of ambition of martyrdom, which the fathers of the church condemned as the fruit of misguided zeal, but which the people considered with reverence. Dying men deplored the natural death which robbed them of the honours of martyrdom. Another form of suicide was allowed by the most illustrious Christian teachers. They allowed a woman to kill herself in order to prevent an involuntary, and therefore an imaginary, pollution of the body, when the mind remained perfectly spotless. They did not, indeed, with Lucretia, claim this privilege from the flame of past violation; but they permitted it, for the prevention of that which was to come. It is needless to observe, that this opinion can be justified by no principle; but it is evidently an excrescence from the principle of a suicide of duty, and proceeds partly from the confusion of guilt with disgrace, and partly also from the abusive application of moral terms to physical things.

Opposed to the voluntary deaths, which are enjoined or applauded, are two classes of culpable suicide, which are termed the criminal and the vicious. A criminal suicide is that by which a man, under the influence of selfish impatience or apprehension, withdraws himself from the performance of evident, urgent, and important duties. This is that kind of selfish suicide which argues, at least, the vicious purpose of withdrawing from the practice of virtue, and destroying the power of rendering service to mankind. For these purposes, life is to be endured when it is miserable, as well as sacrificed when it is most happy. And it must be acknowledged as an indubitable truth, that it is a more excellent habit to regard life as an instrument of serving others, than as a source of gratification to ourselves. Whatever theoretical principles are adopted, it is evident that it can never be praiseworthy, or even lawful, to sacrifice life, but in the observance of duty, or in the practice of virtue; that suicide, to be moral, must be for others; and that if there be a few beings so eminently useful, as well as removable, that their early approaches to an exception, they are to be viewed with that mercy, which is the first virtue of religious creatures, and without which we are unable to contemplate perfection.

Mad. de Stael calls the suicides of duty and virtue by the names of devotion and sacrifice; and they are thus distinguished from the suicides of selfishness. This ingenious female writer discards the vulgar notion, that suicide is a proof of cowardice. To suffer well, it is said, is a proof of patience, of fortitude, and of firmness; but boldly to seek the means of deliverance from suffering, is represented as the office of courage. Patience endures the gangrened limb; courage encounters the terrors of amputation; and it is alleged, that words are distorted from their natural sense, to call that man a coward, who has completely conquered the fear of death. But the question still recurs, whether death is not a lesser evil in the view and estimation of persons disposed to suicide, and under the influence of the principles and feelings that agitate their minds at the moment of reflection and anticipation, than the disgrace or diflire, or other evils, which they would thus endeavour to prevent or escape: accordingly, though a man, generally speaking, cannot be denominated a coward who has vanquished the fear of death, yet he is mere a coward, or at least polluted in a lower degree of virtuous fortune, than a person who has overcome the dread of greater evils, and who has resolution to live in order to encounter them with patience and resignation, till Providence orders his discharge.

Among the most remarkable persons who have contended for the innocence, and even for the merit of some suicides, are two eminent English divines of the 17th century, whose writings have long since sunk into almost total oblivion. The first was the celebrated Dr. Donne, who was probably driven to the contemplation of this question by his own sufferings; and who, during the period of his calamities, wrote a book entitled **Breviary**, and who afterwards bade it "both the presb and the fire," desiring it to be remembered that it was written by Jack Donne, not by Dr. Donne.** This book, which is ingenious but paradoxical, was published many years after his death by his son, a disaffected young man, tempted by his necessities to forget his father's prohibition. (See the biographical article **Dorne**.) Henry Dodwell also, the learned non-juror, maintained the innocence of suicide in some cases, in an apology for the philosophical writings of Cicero, prefixed to a translation of "Cicero de Finibus," by his brother non-juror, the noted Jeremy Collier, a writer remarkable for vulgar threwness and coarse vigour. (See **DODWELL AND COLLIER.** Befides the writers on this subject to whom we have already referred, we may mention Watts against Self-Murther, and Clarke on Nat. and Rev. Religion.

In the East, suicide is in some instances not only legal, but esteemed to be even meritorious; and this is laid to be on the authority of the sacred books of the Hindoos. We are informed by Mr. Colebrooke (At. Ref. vol. viii.,) that legal suicide was formerly common among the Hindoos, and is not now very rare. Widows burning with the corpse of their husbands may be reckoned of this class of self-murder. It is called Sati; and under **Sutter** in this work, a copious account will be found of this horrid sacrifice. Among men, drowning themselves in holy rivers, is often referred to of late than burning. The junction of two rivers is mystically contemplated by the enthusiastic Hindoos, and all acts in themselves good, are rendered vastly better if performed at such a spot. (See **Junctions and Triumphs.** At such junctions, called **Sangam,** enthusiastic Hindoos sometimes drown themselves, or cut their throats. Burning, is, however, occasionally, though rarely, referred to by men. We may here advert to the early instance given of this by Calanus, the Brahman, in the presence of Alexander and his army. (See **Calaun.** His name probably was **Kala.** Some Hindoo poems of great celebrity and beauty describe very pathetically the burning of the aged and blind parents of a small Anchorite, accidentally slain by
one of the monarchs of antiquity, named Daifartha, the
mortal father of the incarnated hero Rama. (See Rama:
and of Daifartha, see something under Sani.) This story
is beautifully told in the Ramayana, and in other poems;
and a text of law is quoted by the commentator to prove
in such cases the legality of suicide. A particular and
very meritorious method of personal combustion, consisting
of fanning the body all over with cow-dung, and setting
it on fire, is called Kari/bagni; which fee. And under the
article Sankaracharya will be seen an instance of its
application on the person of the celebrated and elegant
scholar of that name. Perious afflicted with loathsome,
and incurable diseases, have not unfrequently casued them-
selves to be buried alive. Among the lowest tribes of
the inhabitants of Berar and Gondiwalla, suicide is occasionally
vowed by such persons in return for boons solicited from
idols; and is fulfilled by the successful votary throwing
himself from a precipice situated in the mountains between
the Tapto and Nirmada rivers. The annual fair held near
that spot at the commencement of spring, usually witnessed,
it is reported, eight or ten victims of this superstitious.

In the Mahratta country, in Benares, and probably in
other parts of India, there is a particular tribe, which fur-
ishes individuals ready to devote or sacrifice themselves for
the attainment of any object earnestly desired, either by
the individual or the family; or, it is said, even by strangers.
The recovery of a debt is sometimes effected by these
means; and an old woman is usually the medium. Revenge,
as well as money, is bought by this process. The old lady
places herself conspicuously before the door of the debtor,
threatening self-destruction in default of satisfaction; her
blood refting on the head of the uncomplying party. See
Ruskea and Surabhi.

We may conclude, that instances of self-murder on these
occasions rarely occur. Sometimes the creditor, or seeker
of redress, will carry a cow or a calf before the door of the
defendant, or offending person, threatening, in the event of
refusal or delayed satisfaction, to kill it; the fin refting on
the uncomplying party. In these ufages we see how inad-
quate the law is found to be in securing the property of in-
dividuals, and to what shifts they are reduced in seeking the
justice that, under enlightened governments, is fo promptly
afforded.

In the Ayin Akhery is said, that the Hindoo reckon
different modes of suicide to be legal, and free to be preferable
to others. These are, 1. Starvation. 2. Being covered
with cow-dung, and consumed by fire. This is the mode
called Kar/bagni. 3. Being buried in snow. 4. Going
into the sea at the mouth of the Ganges, (the junction of
the holy river and the sea,) there praying and confessing
sins, until the alligators devour the penitent. 5. Cutting
one's throat at Allahabad, at the junction of the Ganges
and Jamna.

Among the various methods of legal or meritorious su-
icide, said to be in practice with the Hindoes, we should have
expected to find that concerning which we have lately heard
so much, viz. being crushed under the wheels of the ponde-
rous car of the god of Jagnath, and other idols. (See Ja-
ganath.) But we are inclined to think, that the victims of
superstitious, thus self-immolated, are not by any means so
numerous as might be supposwed from some recent publica-
tions. Dr. Buchanan, in his interesting tract, entitled "Chri-
stinian Recherches in Asia," describes his visit to Jaga-


he was present on the grand days of the procession, at the
most crowded seafon, and attended closely at the wheels of
the car. Among the many thousands of pilgrims that re-


bort to Jaganath at the annual fair,—so many thousands,
that a hundred thousand, more or less, are scarcely, it is
said, observable,—it might be reasonably expected that some
individuals would be mad or euthaustic enough to throw
themselves before the chariot-wheels, and be crushed to
death. This, we think, is likely to happen occasionally;
but we believe it is not common. The writer of this article
has attended, in different parts of India, the procession of
the ponderous cars, on which the idols of Hindoo worship
are annually exhibited to the admiring populace; but he
never saw an instance of immolation; nor did he ever know
any one, and he has inquired of many persons, who had seen
such. All have frequently heard of them. The story is
handled from one to another, and believed by most.
The language and practice of the Hindoes, however, seem
to familiarize the terms of legal suicide and veinal falsethood.
See Saraswatj.

SUIDAS, in Biography, the author of a Greek Lexicon,
of whom so little is known, that some have doubted whether
a person of this name ever existed. But his name is actually
found in all the MSS. of his lexicon, and is often mentioned
by Rufinus in his Commentary upon Homer. Croesus
and some others suppose that he lived under Constantius,
the son of Leo, emperor of the East, who began his reign
in 912; and others say, that he lived at a later period than
the year 1180. Bentley says of him, that he has brought
down a point of chronology to the death of the emperor
Zimicces, i.e. to the year of Christ 973; so that he seems
to have written his Lexicon between that time and the death
of the succeeding emperor, which was in 1035. The
Lexicon is a compilation from various authors, made some-
times with, and sometimes without, judgment and diligence.
Notwithstanding its errors and imperfections, it is an useful
book, and a storehouse of all sorts of erudition. It fur-
nishes an account of poets, orators, historians, &c. with
many excellent passages of ancient authors, whose works are
lost. It was first published at Milan in 1499, in Greek,
and has been twice printed with a Latin version; but the
best edition is that of Kuller, printed at Cambridge, with
a Latin version and notes, in 1705, in 3 vols. fol. On this
edition Touph has bestowed much pains. Fabricius has
a large alphabetical index of the authors mentioned by Suidas
in his Lexicon.

SUIEN-PIN, in Geography, a town of China, of the
third rank, in Tche-kiang; 25 miles N.W. of Tchau-
tcheou.

SUJERMA, a town of Hindoostan, in the cirkar of
Gohud; 25 miles W. of Gohud.

SVIJAGA, a river of Russia, which runs into the
Volga, near Sviatz, in the government of Simbirk.

SVIJAJSK, a town of Russia, in the government of
Kajan, at the union of the river Sviagha with the Volga;
20 miles W. of Kazan. N. lat. 55° 45'. E. long. 48° 34'.

SUI-KEOU, a town of China, of the third rank, in
Chen-fi; 20 miles S. of Tai-yuen.

SUILEKEM, a town of the island of Bommelvaert;
5 miles W. of Bommel.

SUILLEAT, a river of England, in the county of
Oxonfer, which runs into the Avon, near Tewkesbury.

SULLUS, in Botany, a name given by Micheli to a
kind of Fungus, called Foricum in Italian, either because
it is the favourite food of hogs, or only fit for those animals
to eat. There are, however, some wholesome species,
which, with the noxious ones, are now referred to the Boletus of Linnæus, Perforo, &c.

SULLY, in Geography, a small island in the Bristol Channel, near the coast of South Wales. N. lat. 51° 23'. W. long. 2° 11'.

SVINOE, one of the Faroe islands, in the North Atlantic ocean. N. lat. 61° 56'. W. long. 6°.

SUPPES, a town of France, in the department of the Marne, and chief place of a canton, in the district of Châlons-sur-Marne, on a river of the same name; 15 miles W. of St. Mesenhouse. The place contains 2165, and the canton 6649 inhabitants, on a territory of 327¼ square miles, in 16 communes. Alto, a river of France, which runs into the Aisne, 6 miles N.E. of Rouay, in the department of the Aisne.

SVIR, a river of Russia, which forms a communication between the lakes Ladoga and Onizeloe.

SUIRE, or Siva, a river in Ireland, which rises in the western parts of Slieveblom, but chiefly from the lofty eminence of that mountain called Ben-dagh, i.e. the black hill, on the confines of the King's county and Upper Ormond. This river falls from four miles through a very fertile part of the county of Tipperary, watering the towns of Thurles, Holy Cross, and Cashel; and continues nearly in the same direction until obstructed by the Waterford mountains, where it is compelled to take a northerly course through Clonmel, and thence to Carrick-on-Suir. Here it leaves the county of Tipperary, and flows easterly, forming the boundary between the counties of Waterford and Kilkenny. It next passes the city of Waterford, and, about eight miles lower, forms a fine confluence with the Barrow, already augmented by the Nore. These united rivers flow together several miles, until they fall into St. George's Channel, at the beautiful bay of Waterford. They are called the Three Sifters, as having their sources in the same mountain, and, after widely separating, thus meet before they come to the sea.

The Suir is navigable for ships of large burden as far as Waterford, and for smaller vessels to Clonmel. It is about 100 miles in length, and its banks, in many parts, are remarkable for rich and romantic scenery. There are several bridges to cross this river; but the largest is that at Waterford, which is about 800 feet across. The tide rises here from nine to twelve feet, and is perceptible many miles higher. The water, in these parts, occasionally exhibits a phosphoric appearance, which varies at different times of the year, but is chiefly remarkable at the high or spring tides in autumn. See Barrow, Nore, and Slieblom.

SUIRDFORD. See Schweinfurt.

SUISOPOUR, a town of Hindoostan, in the cirque of Rantapour; 36 miles S.E. of Rantapour. N. lat. 26° 41'. E. long. 77° 15'.

SUIT, SUTE, SEISE, in Law, (from the French suite, a following another,) is used in divers senses. As, suit in law, which is of two kinds, real and personal; the same with what we call real and personal actions; from which also proceed mixed actions. See Action.

Suit in Equity or Chancery, commences by preferring a bill to the lord chancellor in the style of a petition, praying relief at his hands, and also proceeds of subpoena against the defendant; perhaps by this or that action. The suit in equity is also prayed, commanding the defendant to cease. The bill must call all necessary parties before the court, otherwise no decree can be made to bind them, and must be signed by counsel, as a certificate of its decency and propriety. When the bill is filed in the office of the fix clerks, if an injunction be prayed therein, it must be at various stages of the cause, according to the circumstances of the case. But, upon common bills, as soon as they are filed, process of the subpoena is taken out; which is a writ commanding the defendant to appear and answer to the bill, on pain of 100£. And if the defendant, on service of the subpoena, does not appear within the time limited by the rules of the court, and plead, demur, or answer to the bill, he is said to be in contempt, and is liable first to attachment, then to an attachment with proclamation, next to committal of rebellion, afterwards to the search of a terjeant at arms, and, lastly, to a sequestration. After an order for sequestration issues, the plaintiff's bill is to be taken pro confesso, and a decree to be made accordingly. But if the defendant is taken upon any of this process, he is to be committed to prizon till he puts in his appearance or answer, and performs what this process is designed to enforce, and clears his contempt by paying the charges.

The process against a body corporate is by distinguishing, to detach them by their goods and chattels and process, till they shall obey the summons of the court. And for the process against a peer and member of the house of commons, see Letter Misse.

If the defendant appears regularly, and takes a copy of the bill, he is next to demur, plead, or answer. See Daumier and Pello.

The most usual defence that is made to the plaintiff's bill is an answer given in upon oath, or the honour of a peer or peers; but where there are amicable defendants, their answer is usually taken without oath, by consent of the plaintiff. If the defendant lives within twenty miles of London, he must be sworn before one of the masters of the court; if farther off, there must be a domicil potestate in his answer in the country, where the commissioners administer to him the usual oath; and then, the answer being sealed up, either one of the commissioners carries it up to the court, or it is sent by a messenger, whorawer he received it from one of the commissioners, and that the same has not been opened or altered since he received it. An answer must be signed by counsel, and must either deny or confess all the material parts of the bill; or it may confess and avoid, i.e. justify or palliate the facts. If one of these is not done, the answer may be excepted to for insufficiency, and the defendant be compelled to give another. A defendant cannot pray any thing in this his answer, but to be dismissed the court; if he has any relief to pray against the plaintiff, he must do it by cross-bill.

After answer put in, the plaintiff, upon payment of costs, may amend his bill, either by adding new parties or new matter, or both, and the defendant is obliged to answer afresh to such amended bill. But this must be before the plaintiff has replied to the defendant's answer, by which the cause is at issue; for afterwards, if new matter arises, which did not exist before, he must set it forth by a supplementary bill. There may be also a bill of revoir, and likewright a bill of interpleader, where a person who owes a debt or rent to one of the parties in suit, but, till the determination of it, he knows not to which, desires that he may interplead, that he may be safe in the payments. In this case, it is usual to order the money to be paid into court, for the benefit of such of the parties, to whom, upon hearing, the court shall decree it to be due.

If the plaintiff finds sufficient matter confessed in the defendant's answer to ground a decree upon, he may proceed to the hearing of the cause upon bill and answer only;
in which case, he must take the defendant’s answer to be true in every point. Otherwise the court is for the plaintiff to reply generally to the answer, averring the bill to be true, certain, and sufficient, and the defendant's answer to be directly the reverse, which he is ready to prove as the court shall award; upon which the defendant rejoins, averring the like on his side, which is rejoining ifue upon the facts in dispute. These are proved by examination of witnesses, and taking their depositions in writing. For the purpose of examining witnesses in or near London, there is an Examiner’s office, and elsewhere it is done by commissio. When the depositions of witnesses are taken, they are transmitted to the court with the same care that the answer of a defendant is sent. When they are all examined, the depositions may be published, by a rule to pass publication; after which they are open to the inspection of all the parties, and copies may be taken of them. The cause is then ripe to be set down for hearing, which may be done at the procurement of the plaintiff or defendant before either the lord chancellor or the master of the rolls, according to the discretion of the clerk in court, regulated by the nature and importance of the suit, and the arraignment of causes depending before each of them respectively. Either party may be summoned to hear judgment on the day fixed for the hearing; and then if the plaintiff does not attend, his bill is dismissed with costs; or if the defendant makes default, a decree will be made against him, which will be final, unless he pays the plaintiff's costs of attendance, and gives good caue to the contrary on a day appointed by the court. A plaintiff's bill may also at any time be dismissed for want of prosecution, which is in the nature of a nonsuit at law, if he suffers three terms to elapse without moving forward in the cause. For the method of hearing causes, see Hearing.

The chancellor's decree is either interlocutory or final. If any matter of fact is strongly controverted, it is referred to a jury upon a feigned issue.

If a question of mere law arises in the course of a cause, it is referred to the opinion of the judges of the court of king’s bench, upon a caue flated for that purpose. Another thing also retards the completion of decrees. Frequently long accounts are to be settled, incumbrances and debts are to be inquired into, and a hundred little facts to be cleared up, before a decree can do full and sufficient justice. These matters are always by the decree on the first hearing referred to a master in chancery to examine, which examinations frequently last for years, and then he is to report the facts, as it appears to him, to the court. This report may be excepted to, disproved, and overthrown, or otherwise confirmed, and made absolute by order of the court.

When all ifues are tried and settled, and all references to the matter ended, the cause is again brought to hearing upon the matters of equity referred; and a final decree is made, the performance of which is enforced (if necessary) by commitment of the peron, or sequestration of the party's estate. And if by this decree either party thinks himself aggrieved, he may petition the chancellor for a rehearing. But unless a rehearing be defined, the decree signed by the chancellor, and enrolled of course. (3 Geo. II. c. 30.) However, a bill of review may be had on sufficient cause alleged: and from this court the dernier resort is a petition of appeal to the house of lords. Bl. Com. vol. iii.

Suit of Court, or Suit of Service, an attendance which the tenant owes the court of his lord. See Secta and Service.

Suit Covenant, when your ancestor hath covenanted with nine to fuc to his court.
much as in them lies; and if individuals refuse, it is the
bounden duty of the legislature, on a general scale, to do
any thing, and every thing in its power, towards the re-
moval of grievances, which may and ought to be removed,
and to which nothing can be objected, but the pride and
caprice of a few individuals; justice being no further con-
cerned than in pecuniary compensation. The crown has lately
fet a high example, by the sale of many, if not most of its
claims of this nature, at a fixed and moderate rate; an ex-
ample, which it is very defirable may be enforced on all
inferior lords, who indeed themselves, it must be presumed,
in fact and law, held only of the crown.

SUITÉ, Fr., a suit, fet, or feries of movements, in
Musice. At the beginning of the last century, there were
two kinds of fonatas and concertos in Itale; the one was
called fonate et concerti da chiesa; and the other, fonate et con-
certi da camera. The compositions da chiesa, for the church,
were more grave, studied, and rich in harmony. While
those da camera, or private concertos, were composed of a
set of light dancing air, as an allemanda, corrente, minuetto,
fandango, gavotta, and giga, or jig. Those the French
call fait; and Handel calls his two first books of leffons,
Suites des Pieces. The first and third fet of Corellis fonatas
were composed for the church; the second and fourth for the
chamber. And his first eight concertos are concerti da chiesa,
and the last two concerti da camera. And as it was very
common in Italy, on great fes, for the principal violin
to play foles between the several parts of the masses, or be-
tween the motetto fongs by great vocal performers, we be-
thieve that the first fes of Corelli were composed for and played in the church; and the fix last for the chamber.

SVITEI, in Geography, a town of Sclavonia, on the
Save; 23 miles E.S.E. of Posega.
SUK el Harf, a town of Arabia, in the country of
Yemen; 28 miles S.E. of Saade.
SUKAKO, a town of Sweden, in the government
Ulea; 12 miles from Braheild.
SUKAIS, a town of Sweden, in the government
Abo; 23 miles N. of Bornoneborg.
SUKAN, or SUKAN, a town of the desert of Syria,
neat Charid; a warm sulphurous spring; 140 miles S.S.E.
of Aleppo.
SUKASERAY, a town of Hindooftan, in the cir-
car of Chandere; 15 miles S.W. of Seronge.
SUKASSA, a town of Africa, in the Vled de Nune.
N. lat. 27° 23' 11" W. long. 10° 10' 11".
SUKERRABA, a town of Arabia, in Yemen; 4 miles
S.S.E. of Othama.
SUKE-SHUE, SHUKESHY, or Shububu. See SHU-
HUHU.
SUKI, a town of Asiatic Turkey, in Natolia, governed
by an aga; 12 miles N.E. of Milet.
SUKKONDA, a town of Africa, on the Gold Coaf, in
district of Anta; where the trade in gold is very
considerable, and where the English, French, and Dutch,
have factories and forts.
SUKOR, or SUNKAR, a town of Hindooftan, in
Sehwan, on the Indus; 5 miles W. of Behker.
SUKOS, a town of Bengal; 18 miles N.E. of Nat-
tore.
SUKOTYO, in Zoology, a genus of the class and
derder Mammalia Bruta. Horn on each side near the eyes.
There is only one

Species.

INNUSUS. This species has an upright mane, which is
short, narrow, reaching from the top of the head to the
rump. This animal is described by Dr. Shaw. "This," ac-

ording to Niewhoff, its only describer, and who has
figured it in his Travels to the East Indies, "is a quadruped
of a very singular shape. Its size is that of a large ox;
the snout like that of a hog; the ears long and rough, and
the tail thick and bushy; the eyes are placed upright in the
head, quite differently from those of other quadrupeds.
On each side the head, next to the eyes, stand the horns, or
rather the teeth, not quite so thick as those of an elephant.
This animal feeds on herbage, and is seldom taken. It is
a native of Java, and is called by the Chinese Sukotyo." Niewhoff was a Dutch traveller, who visited the East
Indies about the year 1563, and continued his peregrinations
for several years.

SUKPORAH, in Geography, a town of Hindooftan,
in Bahar; 4 miles N.E. of Bahar.
SUKRIA, a town of Peria, in the province of Irak;
42 miles N. of Hamadan.
SUKTUESKOI, a fortress of Russia, in the govern-
ments of Irkutki; 128 miles S.S.E. of Nertchink.
SUKULSDERAI, a town of Hindooftan, in Oude; 18
miles W.N.W. of Luckow.
SULA, a river of Russia, which runs into the Vitchegea
near Uf Sifolke.—Allo, a river of Russia, which runs into
the Dnieper, 16 miles N.W. of Gorodische, in the govern-
ment of Kiev.
SUL, in Ornithology, a name given by Hoier, and some
others, to a bird, described as a distinct species of the web-
footed water-fowl, but seeming to be no other than the
anfer breonis, or island goos.
SULAK, in Geography, a river of Russia, which runs
into the Caspian sea, 8 miles N. of Atrachane.
SULAPOUR, a town of Hindoostan, in Dowlatabad;
15 miles S. of Naldourouk.
SULASSA, a town of Persia, in Khorasan; 350 miles
N.N.E. of Herat.
SULAT, a town on the E. coast of Sumur. N. lat.
12° 5', E. long. 125° 30' 0'.
SULAU, or ZULAU, a town of Silezia, which gives
name to a lordship, in the principality of Oels; 17 miles
N.W. of Oels. N. lat. 51° 6', E. long. 17° 10'.
SULAW, a town of Germany, in the Middle Mark of
Brandenburg; 4 miles S.W. of Zoeilen.
SULBEEK, a small island of Prussia, in the Curich
Haft, at the mouth of the Ruf.
SULCATED LEAF, among Botanists. See LEAF.
SULDINGEN, in Geography, a river of the country of
Hoya, which runs into the Wefer, 4 miles S. of Bahren-
burg.
SULDORF, a town of Westphalia, in the duchy of
Magdeburg; 8 miles S.S.W. of Magdeburg.
SULÉC, a town of the duchy of Warnaf; 45 miles
N.E. of Geneva.
SULEHIE, a town of Egypt, on the right bank of
the Nile; 8 miles S.S.E. of Aina.
SULEJOW, a town of Poland, in the palatinate of
Sirdia; 50 miles E. of Sirdia.
SULÉN, a river of the duchy of Berg, which runs into
the Rhine, 7 miles above Cologne. SULEN ISLANDS, a clifer of small islands in the North
sea, near the coast of Norway, N. lat. 61° 5', E. long.
4° 41'.
SULENDORF, a town of the principality of Lune-
burg-Zelle; 9 miles E. of Ulten.
SULGEN, a town of Switzerland, in the canton of
Zurich; 15 miles N. of Zurich.
SUL

SÜLEN, or Suling, a town of Austrian Swabia; 21 miles N.E. of Salamanfweiler.

SÜLG, or Sylg, a river of the Tyrol, which runs into the Adige, near Glurnez.

SÜLIAGO, or Suliago, a chain of small islands in the Pacific ocean, about 90 miles in length, and 12 in breadth. N. lat. 9° 24′ to 10° 33′. E. long. 125° 27′ to 128° 36′.

Süliago, an island in the Pacific ocean, about 20 miles in circumference, and 20 miles distant from the north-east coast of Mindanao; which gives name to the above-mentioned cluster. N. lat. 9° 27′. E. long. 126° 27′.

SÜLIAO, or Suriago, a town of the north coast of Mindanao, in a bay between two protecting capes. N. lat. 9° 45′. E. long. 126° 31′.

SULIPACHA, a town of South America, in the province of Tucuman; 130 miles N. of St. Salvador de Junjú.

SÜLISKAR, or Bora, a small island in the North sea, about 45 miles from the north-west part of Scotland. N. lat. 58° 44′. W. long. 5° 53′.

SÜLITELMA, the highest of all the mountains of Lapland, and which the natives have long regarded with a kind of awe, is situated in N. lat. 67° 10′, near the margin of a lake that communicates with the Western ocean. It forms three peaks, which have the several elevations of 5520, 5620, and 5910 feet. These peaks are covered with an accumulation of eternal snow, compressed into an extremely hard substance, of the depth perhaps of 100 feet. The sides of the mountain, at the altitude of about 2500 feet, exhibit real glaciers, consisting of icy vaults, sometimes 300 feet high, clutered with sharp-pointed pyramids of solid ice, which is perfectly clear and colourless; but its clefts appear blue. Near the base of this mountain the lake Lomeniari, with an elevation of only 2265 feet above the level of the sea, has a great quantity of snow lying on its banks through the whole year. Half a degree farther north, the Virjari, at an altitude of 1900 feet, is covered with ice in the middle of summer. These observations agree very well with theory, which gives from 2232 to 2236 feet for the height of the mean boundary of congelation in these latitudes. A little below this limit we may place the ordinary clefts of the glaciers, which seem to owe their formation to the alternate influence of thaw and frost, in changing, by degrees, the lower zone of snow into an icy wall. The beautiful and fantastic groups which these glaciers often present are, by the simplicity of the northern tribes, ascribed to the invisible powers of magic. They are hence called "Jegna" in Lapland, and "Jöckel" in Iceland, and "Gyckel" in some parts of Norway, from the Gothic verb "gyckla," the same as the German "gaukela," to trick or bewitch the eye.

The term "Sulitelma," and "Ben-la-di." the name of a remarkable mountain in Pershtireh, have the same origin; meaning, in the Lapland and Gaelic languages, "the hill of God!! the rude inhabitants of both countries being accustomed anciently, at certain feasts, to perform religious rites on their summits.

SULKAVA, a town of Sweden, in the province of Tavastland; 1158 miles E.N.E. of Tavathus.

SüLENKAI, or Suling, a town of Hinder Pomerania; 10 miles W.N.W. of New Stettin.

SÜLKUZA, a town of European Turkey, in Bessarabia; 16 miles S. of Bender.

SÜL, in Agriculture, a term applied sometimes to a plough. (See Flough.) It is the name of the old plough, especially that of Devonshire.

SUL-Paddle, a term applied to a plough-paddle; the name of the paddle by which old ploughs were cleaned from the earth which hung about them.

SÜLLAGE, in Rural Economy, a term applied to a drain of filth, or the dirt cleaned up from the streets.

SÜLLANE, in Geography, a river of Ireland, in the county of Cork, which runs into the Lee, 15 miles W. of Cork.

SÜLFELD, a town of the duchy of Holstein; 10 miles S.S.W. of Segeborg.

SÜLLIVAN, a post-township of America, in New York, at the north extremity of Madison county, bounded north on Oneida lake, east by Lenox, south by Cazenovia and Smithfield, and west by Onondaga county; about 14 miles from north to south, and 54 from east to west. Sullivan was first erected in 1803, then in Chenango county; and in 1809, the eastern and largest part was erected into the town of Lenox. The settlements commenced about 1798. The population of this town is 1774. The southern part is hilly, but the northern and largest part is quite level. The Canaseraga and Chittenango creeks furnish good mills in abundance. Here are eight school-houses and a meeting-house. It furnishes iron-ore, but its chief mineral is gypsum. — Allo, a county of New York, ereched in March, 1803, from Ulster county; so called in honour of General Sullivan, an officer in the revolutionary army. Its form is irregular, and the whole area may be computed at 625,000 acres. It is bounded north by Delaware county, east by Ulster county, south by Orange county, and west by the Delaware river, or the state of Pennsylvania; situated between 41° 24′ and 42° N. lat., and 71′ and 7° 68′ W. long. from New York. It contains, besides Thompson the capital, Bethel, including 737; Liberty, having 410; Lumberland, with 525; Mamakating, with 1865; Navinlock, having 935; and Rockland, including 309 inhabitants; the whole population consisting of 6108, and the number of electors being 466. This county is distant 80 miles, in a right line, about S.W. from Albany, and about the same distance N.W. from New York, and 41 miles W. from the Hudson. A large proportion of the county is mountainous, though the vales and plains are extensive and fertile. It has several streams, besides the Delaware river, that forms its well boundary; and several small ponds and lakes, the principal of which are White lake, Black lake, and Great lake, or lake Superior. In 1810 this county had 1597 spinning wheels, 259 looms, 1252 sheep, and 48,923 yards of cloth produced from household industry. Ulster and the county fend four members to the house of assembly. — Allo, a township of Chemehug county, in New Hampshire, containing 516 inhabitants. — Allo, a post-town of Maine, in Hancock county, in Frenchman's bay; 23 miles N.W. of Goldsborough; containing 711 inhabitants. — Allo, a county of East Tennesee, in Washington district, containing 6647 inhabitants, of whom 773 are slaves. At the court-house there is a post-office.

SÜLLIVAN'S ISLAND, one of the three islands which form the north part of Charleston harbour, in South Carolina; about 7 miles S.E. of Charleston. — Allo, an island in the Mergui Archipelago; about 35 miles in extent from north to south. N. lat. 10° 48′ to 11° 21′.

SÜLSONIACE, in Ancient Geography, a station of Britain, in the second iter or route of Antonine, placed between Verolamium or St. Alban's and London; 9 miles from the former, and 12 from the latter; which all our antiquaries agree to have been at Buckleigh hill, where many Roman antiquities have been found. Mr. Baxter, and
SULLY, MAXIMILIAN DE BETHUNE, DUKE OF, in Biography, marshal of France, and prime minister under Henry IV., was born at Rofni in 1559, and educated by his father, who had sprung from an illustrious family of the ancient counts of Flanders, in the reformed religion, to which he hedged his son, even in his tender years, through life. At the age of eleven he was presented to the queen of Navarre, and her son Henry, whom he followed to Paris, where he pursued his studies. Here he lay concealed for three days, during the horrible massacre of St. Bartholomew's in 1572, and thus, by favour of the principal of the college of Burgundy, he escaped the fate to which all the Huguenots were condemned. At this time Sully entered into the service of the king of Navarre; taking leasons in history and mathematics from the young king's preceptors; and, in some years, he entered into the army. After the death of Charles IX., Henry of Navarre quitted the court, and placed himself at the head of the Huguenot party; and on this occasion Sully entered into the ministry of a volunteer. In his youth he manifested more valour than military skill; but he possessed another very important and useful quality, which was economy, and which enabled him to maintain his own expenses a company of cavaliers: and it was by the exhibition of this quality that he gained the friendship and confidence of Henry. In 1580, the king conferred upon him the office of counsellor of Navarre, and that of his own chamberlain. During the time which he spent in the service of the duke of Anjou, brother to Henry III., and in which he entered for the purpose of regaining some property that belonged to his family, he attended that prince in his visit to the English court; but when he found that the bigotry of the duke led him to treat his Protestant followers with coldness and indifference, he abandoned his service, and returned to that of the king of Navarre. Henry willing at this time for a confidential person, whom he could employ at the court of France to watch and penetrate the design of the League, sent Rofni thither for this purpose in 1583. During his residence there he married, at the beginning of 1584, Anne de Courtenay, descended from an illustrious family of that name. In the following year he was summoned by Henry to assist in the approaching war with the League; and having joined him without hesitation, he presented him with a sum of money which he had amassed, and which was honourably employed in various sieges and battles. In 1586 he concluded a treaty with the deputies of Switzerland, by which they stipulated to furnish 20,000 men for the royal cause. In the battles of Coutras and Ivry he acquitted himself so well, that his fidelity and bravery were signalized by the approbation and applause of Henry. Having lost his wife, he married again in 1592, and for some time lived in retirement. But being neglected by Henry, who was now lawful king of France, he zeal in his service was somewhat abated; however, when his presence and assistance became necessary, his affection for his master induced him to forget any apparent or real flight, to which he had been treated, and to aid him again with his counsel. Henry, being a Protestant, found it difficult to maintain, without very hazardous struggles, his tenure of the throne; and began seriously to think of reconciling himself to the Catholic faith. But one of his chief objections was an apprehension that he should thus offend his former faithful friends, and reduce himself to the necessity of fighting against them. Rofni, more consistently perhaps to principles of policy than to those of truth and integrity,

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persuaded him to adopt the measure, to which his interest more than the conviction of his judgment led him to incline. His arguments prevailed; and Sully himself was employed to negotiate with the Catholic chiefs on the ground of Henry's abjuration of Protestantism. Sully, however, never sacrificed his own conscience or professions; but he acted in this instance with a firmness, that religion was a matter of little importance to Henry himself, and that the question, whether he was to be denounced Calvinist or Catholic, was of trivial consideration compared to that, whether there were to be peace or war in France. Such temporizing measures, however, cannot be said to reflect honour either on the counsel of Sully or the character of Henry; nor did they immediately produce the effect which might have been expected. The League, supported by Spain, continued to oppose Henry's tranquil possession of his crown; and for this purpose the talents of Sully, both in the cabinet and the field, were found to be very important and useful. Accordingly they were called forth into vigorous exertion; and in the progress of his promotions, he was made secretary of state in 1594, member of the council of finance in 1596, and superintendent of the finances in 1598; and, moreover, he was employed in many interesting negotiations, one of which was that for the king's second marriage to Mary de Medicis. Another of Sully's diplomatic missions was that which produced a confidential interview, in 1601, with Queen Elizabeth at Dover. The accession of James I. to the throne of England, in 1603, afforded occasion to another mission of Sully to that island, where, by his reputation and dexterity of management, he succeeded in renewing the treaties subsisting between the courts of France and Great Britain. As a finance minister, Sully contrived to improve the royal revenues, and to lighten the burdens of the people; but our limits will not allow us to detail the measures which he adopted for this purpose. He was no less firm than wise in his conduct on this occasion. While he was refitting applications for oppressive edicts, to which the king, who was always disposed to listen to the requests of his favourites and mistresses, inclined, his mistresses, d'Entraigues, the marchionesses de Verney, hautly paid to him, "To whom would you have the king to grant favours, if not to his relations, courtiers, and mistresses?"—"Madam," he replied, "you would be in the right, if his majesty took the money out of his own purse; but is it reasonable that he should take it from these of the traders, the artisans, the labourers, and peasants? These people, who maintain him and all of us, find one matter sufficient, and has no need of so many courtiers, princes, and mistresses." The conduct of Sully increased the calumny and abuse of those court minions, whose selfish and ambitious views make them heedless of an extravagance by which they profit, however oppressive it may be to the great body of a nation: but Henry approved it, and regarded his minister as entitled to increasing confidence. The spirit of his administration was that of order, regularity, and economy, joined with that forbearance of manners which he derived from the reformed religion. As an enemy to luxury, he did not encourage the introduction of those arts and manufactures which minister to refined gratification; but agriculture, as the basis of national prosperity, he laboured to promote.

The picture of Sully's own life is thus exhibited by one of his biographers, and it is curious and interesting. "He rose every day at four in the morning, and employed his two first hours in reading and dispatching the memorials which lay upon his desk. At seven he went to the council;
and he passed the rest of the morning with the king, who
gave him orders relative to the different offices which he
held. He dined at noon, and afterwards gave a regular
audience, to which perons of all ranks were admitted.
The ecclesiastics of both religions were first heard; then
came the turn of villagers, and perons of inferior condi-
tion; perons of quality were referred till the last. When
this was concluded, he usually refused his labours till
supper-time, when he caufed his doors to be shut, and lay-
ing aside all business, indulged himself in society with a few
friends. He commonly went to rest at ten; but if any
thing extraordinary had deranged the operation of the day,
he borrowed some hours of the night. His table was
simple and frugal; and when he was reproached with its
plainness, he would reply with Socrates, that if his guests
were wise, they would be satisfied; if not, he did not wish
their company." What would be your majesty's treasury,"
was the reply. Sully was firmly attached to his religion, nor
was any temptation that could be
performed sufficient to pervert his mind, and seduce him
from it. The pope even addressed him with a letter of
eulogy on his administration, and closed it by expressing a
wish, that he would enter into the right faith. In his reply
he said, that it was wise to pray God for the holiness of
his conversion." The faithful services of this
excellent minifter were further rewarded by the post of
governor of Poitou, and grand-maister of the ports and
havens in France; and also, in 1606, by the dignity of a
peer, on which occasion he chose to take his title from his
estate of Sully-sur-Loire. He continued at the
head of affairs till the affaffation of Henry, in 1610. He
was then dismissed from court, with a gratuity of 100,000
crowns, and afterwards lived chiefly in retirement. When
he appeared at the levee, it was in his old-fashioned dress,
with a gold chain about his neck, to which was appended a
large medal with the effigy of his deceased mother. It is
said, that when he was once sent for by the young king
Louis XIII., to give his advice on some important affair,
his uncouth figure excited the mirth of some young courtiers.
Sully, perceiving it, and turning to the king, said, "Sire,
when your father, of glorious memory, did me the honour
to call me to his presence, to consult me in state affairs, he
previously sent away the buffoons." Louis felt the rebuke,
and remained alone with Sully. In 1634 he received the
staff of marshal of France, in exchange for his post of
grand-maister of the ordnance. He died in 1641, at the
age of 83 years. A statue was erected to this great man
by Louis XVI., and his eulogy was made a prize-subject
by the French Academy. The "Memoires de Sully,"
entitled by the author, "Oeconomies Royales," were
written without order or connection, and in a very fimple
fyle. They have been several times printed; and the Abbé
de l'Ecluse gave an edition of them in 1745, which were
arranged in better order, and the language was rendered
more correct. They have always been held in high eifen,
on account of their biological and political information,
and the interesting anecdotes of the perfons and court of

SULLY, in Geography, a town of France, in the department of the Loiret, and chief place of a canton, in the district of Gien, situated on the Loire; 12 miles N.W. of Gien. The place contains 2109, and the canton 6180 inhabitants, on a territory of 345 kilometres, in 10 communes.—Alfo, a town of France, in the department of the Saone and Loire; 7 miles E.N.E. of Autun.

SULM, or Sulmach, a river of Wurtzberg, which runs into the Neckar, near Neckar's Ulm.

SULMGAN, a river of Wurtzberg, which rises near Murhard, and runs into the Neckar at Neckar's Ulm.

SULMONA, anciently called "Sulmo," the place of
Orid's nativity, a town of Naples, in Abrazzo Citra, the
seat of a bishop, containing 11 churches and 12 convents;
21 miles S. of Civita Chieti. N. lat. 42° 3'. E. long.
13° 50'.

SULOW, a town of Poland, in the palatinate of San-
domirz; 8 miles N.W. of Malogocz.

SULPHATES, in Chemistry and Mineralogy, a name
given to crystallizable salts, formed by the combination of
any base with the sulphuric acid; alumine requiring the pre-
ence of potash or ammonia in order to crystallization. The
sulphates are scarcely decomposable by heat alone, but when
infused in contact with charcoal, or any carbonaceous matter,
they are converted more or less completely into sulphures;
which fee. In pure alcohol they are all infusible. All the
folutions of these salts are decomposed by the other salts of
barytes entirely, and nearly so by the salts of lime, the acid
forming a precipitate with these earths. A fimilar decom-
position takes place when any sulphate is added to the soluble
salts of lead, silver, and other metals, whose sulphates are
little soluble. None of the sulphaes are entirely decom-
posed at a moderate temperature by any other acid; the
sulphur being the highest in the order of affinity, with
very few exceptions. But some of the acids partially de-
compose the sulphates, and by taking part of their base,
they reduce the remainder to the state of acid-sulphates.
The nitric and muriatic acids are of this kind, and the tar-
aceous, with regard to the sulphate of potash. But the
acids that are fixed in the fire, such as the boracic, phos-
phoric, and arsenic, decompose the sulphaes totally, in a
red heat long continued.

SULPHATE of ALUMINE, is a ternary compound of argil
or alumine, potash and sulphuric acid. The sulphate of
alumine is made by dissolving pure alumine in equally pure
sulphuric acid, at a boiling heat, evaporating the solution
to complete dryness, and then redissolving the residue in water.
Vauquelin distinguishes seven different kinds of sulphate of
alumine. He has shown, that if a few drops of solution of
potash, or of sulphate of potash, be added to an uncrystal-
lizable solution of sulphate of alumine, the crystalliza-
tion will immediately commence. Sulphate of alumine is
insufible in any heat; but when strongly urged in the fire, it
parts with its acid altogether. (See ALUM and ALUMINE.)
Alum is well known as an article of the materia medica, and
is used as an internal and external remedy for restraining
violent hemorrhages. It is also administered in cases of ob-
ininate diarrhoea, diabetes, and flour albus; though Dr.
Cullen says that it is not to be depended upon in the two latter
diseases. In internments it has been recommended as an
auxiliary to cinchona, and also in confluent small-pox, when
the pulses are bloody; and Dr. Percival regarded it as a
prophylactic in colica pictonum, and a cure for lighter
causes. It is used locally in gargles, and as the basis of in-
fusions in cases of gleet and leucorrhoea, and of colliria in
chronic ophthalmia. The dose in hemorrhages is from
grams 5 to 10, repeated every hour or two, till the bleeding
abates. It is sometimes administered diffused in the serum of
milk, in the form of whey, prepared by boiling 31 of powdered
alum in a pint of milk, and straining. The dose of the whey is
1/2 of or 1/3 of. The official preparations of alum are as
follow; vis. alumen extractum, or dried alum of the Lond.
Ph., prepared by melting alum in an earthen vessel over the
fire,
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fire, and increasing the heat until the ebullition cease; or, \textit{fulvus aluminis nigricans}, olim, \textit{alumen ybun}, dried sulphate of alumine, formerly burnt alum, of the Edinb. Ph., obtained by melting sulphate of alumine in an earthen or iron vessel, and kept over the fire until it cease to boil; or, \textit{alumen ybun}, burnt alum of the Dub. Ph., prepared by exposing any quantity of alum to the heat of a strong fire in an earthen vessel until it cease to boil. This dried alum has a more astringent taste than the crystallized salt; it is obtained in the form of a light, opaque, white, spongy, friable mass, 100 parts of which contain 36.25 acid, and 63.75 alumine. It is chiefly used as an astringent, to deflux fungus in ulcers, and has been also given internally to the amount of 2 or 3 for a dose in cases of colic.

The \textit{liquor aluminis compositus}, or compound solution of alumine of the Lond. Ph., is prepared by dissolving alum and sulphate of zinc, of each half an ounce, in two pints of boiling water, and filtering the solution. This is astringent and detergent, and is employed as a lotion for cleansing ulcers, and in some cases of cutaneous eruptions. Properly diluted, it is a useful collirium in ophthalmia, and an injection in gleet, and in flor albus, when the discharge proceeds only from the vagina.

\textit{Pulvis fulvus aluminis compositus}, is described under Powders.

\textit{Solutio fulvus aluminis composita}, or compound solution of sulphate of copper of the Edinb. Ph., is prepared by boiling fulvate of copper, sulphate of alumine, of each 3 oz., in 2 lbs. of water, in order to diffuse them, and then adding to the liquor filtered through paper, \textit{\textdegree} oz. of sulphuric acid. This is sometimes used as a lotion for hæmorrhages; and, largely diluted, as a lotion in ophthalmia, and for the treatment of the purulent ophthalmia of infants.

\textit{Sulphate of Ammonia}. See \textit{Sal Ammoniacs}, and \textit{Salts}.

This saline sublimate promotes vegetation; but, according to lord Dunonald, it is not to be had in such quantities as to render it an article of much importance to agriculture.

Sir Humphrey Davy found in some trials, that the effects of this sulphate, as well as those of some others, were, in a certain degree, injurious to barley and grass growing on a light sandy soil, in all cafes, when used in a proportion which equalled one-thirtieth part of the weight of the water in which they were diffused, but less so in this than some others. But that when the proportion was one three-hundredth part, the effect was different. The plants watered with a solution of it of this strength grew in exactly the same manner as similar plants watered with rainwater.

\textit{Sulphate of Barites}. See \textit{Barites}, and \textit{Salts}.

\textit{Sulphate of Copper}. (See Copper.) This salt, as an article of the materia medica, is emetic, astringent, and tonic, when taken internally. As an emetic, it has been given in the early stage of phthisis, and where laudanum has been taken as a poison; and as an astringent and tonic, in alvine hæmorrhages, intermittent fever, epilepsy, and some other specific affections; but other remedies, equally powerful and less injurious, should be employed, and the use of this discontinued. Externally it is employed as an astringent, to confine fungus, and in solution as a stimulant to foul obstinate ulcers. It forms the basis of a very unchemical preparation, Bate’s “\textit{aqua camphorata},” which Mr. Ware recommends, diluted with 16 parts of water, in the purulent ophthalmia of infants. As an emetic, the dose is from gr. i to vi, in f 3 of water; but as a tonic, it should be given in the form of pill, beginning with gr. i, and increasing the dose to gr. i; the official preparations are, \textit{fulvus aluminis sulphatis comp.} of the Edinb. Ph., and cuprum ammonium of Lond., Edinb., and Dub. Ph. For the preparation of the former, see \textit{Sulphate of Aluminis}, fuscus.

The latter, or ammoniated copper of the Lond. Ph., is prepared by boiling together in a glastra mortar \textit{\textdegree} oz. of sulphate of copper, and six drachms of subcarbonate of ammonia, until the effervescence ceases; then wrapping up the ammoniated copper in a lubulose paper, and drying it with a gentle heat. The Edinb. Ph. directs it to be prepared by rubbing thoroughly together in a glastra mortar two parts of pure sulphate of copper with three parts of subcarbonate of ammonia, till the effervescence terminates, and they unite in a violet-coloured mass, which is to be wrapped up in a lubulose paper, and dried, first on a chalk-stone, and afterwards with a gentle heat. It is preferred in a well-flapped glastra phial. According to the Dub. Ph. it is obtained by rubbing 1 oz. of sulphate of copper and \textit{\textdegree} oz. of carbonate of ammonia in an earthenware mortar, till the effervescence ceases, and they unite into a mass, which is to be dried, wrapped up in a lubulose paper, and preferred in a phial closed with a glastra stopper. This preparation has the odour of ammonia, a hot, fleshy, metallic taste, and a rich blue colour. The blue colour is lost by exposure to the air, and the salt acquires a greenish hue. It is tonic and antiphlogistic; and has been principally employed in epilepsy, for which it was first proposed as a remedy by Dr. Cullen; who recommends it not to be continued for more than a month at a time. The dose is gr. i, increased gradually to gr. v, given twice a day, either in pills made with crumb of bread, or combined with valerian.

\textit{Sulphate of Iron}. (See Iron.) This salt, known in commerce by the name of green vitriol, is, with regard to its medicinal properties, tonic, emmenagogue, and antiphlogistic; it has been given with advantage in dysentery, in the latter stage of phthisis, and in amenorrhea, depending on a weakened action of the blood-venulae. The dose is from gr. i to vi, combined with ammoniacum, rubarb, myrrh, or bitter extracts. It has lately been used diffused in water, as a lotion to cancerous and phagedenic ulcers. Its official preparation is \textit{tinctura ferri muriatis}. See \textit{Tincture} and \textit{Iron}.

In reference to Agriculture, sulphate of iron is formed naturally in many places in great abundance, according to lord Dunonald, by the spewage of oxygenation, from the phosphorus or pyritic subfusates. These matters are generally found accompanying the coal flata, as well as coal itself; particularly in such coals as are phlogiferous. This salt is very soluble in water, and is in a high degree injurious to vegetation, when it abounds in soils containing clay and siliceous matter, without any admixture of vegetable or calcareous subfusates. It is decomposed by alkaline salts, forming with them vitriolated tartrar, Glauber salts, vitriolic ammonia, gypsum, and Epsom salt. When added to soils containing calcareous matter, and a due proportion of animal and vegetable subfusates, it has been found, when not used in too great quantities, to have produced beneficial effects in promoting the growth of plants; but experiments have not as yet been made fully to ascertain its effects on arable land.

It may be further noticed, that some very interesting observations have been lately made on this subfusate, as contained in peat of Tintgrith-moor, Bedfordshire, by Dr. George Pearn, in a communication prefaced to the Board of Agriculture. And it is stated, in answer to several queries put
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by him to J. W. Willaume, ecf. that, in answering them, he shall divide the subject into three articles; first, the peat considered as an object of fuel; secondly, the ashes; thirdly, the salt of peat, or dust: the two last are objects of manure.

I. Peat.—The peat which is found after the removal of the root or exterior surface, to about a spade’s depth, has long been known as an article of fuel. It is, however, used only by cottagers, who burn it on a brick-hearth; it has been discarded from the parlour, the kitchen, the brew-house, &c. as being injurious to grates, and to all sorts of vessels put on it. It cannot be employed in the roasting of meat, as it will impart a disagreeable taste; and it is destructive of all sorts of furniture by the effluvia which it emits, or by the dust or ashes which may chance to be blown from it. If these disagreeable consequences could be obviated, it might be made an article of general consumption, as a substitute for coal, much to the advantage of the fellar and conserver: it is dug out in the form of a brick to a certain depth, well known to the common labourer. This depth must be carefully attended to, lest you should cut out the staple, in which case it could not be retrieved; but this circumstance being attended to, it will grow again to its former state in the space of fifteen years. Thus the whole moor is divided into proper portions, and periodically once in fifteen years.

II. Ashes.—The turf, or surface, and such parts of the peat as do not appear to be of the best quality, are laid up in considerable heaps, and reduced to ashes by the action of fire. The ashes are red.

Answers to Queries.—1. The ashes have been long known as a manure, and the demand is on the increase.
2. The quantity usually laid on an acre, by spreading or fowing it, is fifty buchells, either on grass or arable land.
3. It is laid on hot land. By hot land, we understand sandy, gravelly, chalky soils of a dry nature, such as are burnt up in a long continuance of hot weather. It is most commonly used for grasses; but it is in considerable esteem as a manure for oats or barley, on land of the nature above-mentioned.
4. The vegetable effect is surprising, inasmuch as it will double or treble a crop of any new-lown grafs, such as trefoil, &c.
5. He has seen the benefits arising from it on old pature-land overgrown with moss, which it effectually destroys, and produces in its stead white or Dutch clover. You may, it is laid, trace to an inch the effusion and recommencement of this manure. It is observable, that near the fire-heaps, as far as the wind can carry the lighter parts of the ashes, the production of clover is sure to be abundant; it is equally favourable to the growth of barley and oats.
6. The ashes are bought by a lot of biglers, who carry them in bags loaded on asles to a considerable distance, where they are known to be in great repute: they must come excessively dear to the consumer by this mode of conveyance. The farmers in the vicinity fend for them in waggon, particularly Mr. Brumby, near Sundon, in Bedfordshire, a considerable and intelligent farmer, who increases his consumption every year, both for his grass and arable land.

III. The Salt of Peat, or Dust.—1. The dust or grey saline substance is produced by heating the earth containing this salt to a powder; it is found in particular spots, not universally, the earth not being equally impregnated with it in all places: it has not been known as a manure above fix years; but on trial, greatly increases, it is laid, in reputation and demand.
2. Fifty buchells are the proper quantity per acre. This should not be exceeded, for if it be laid on in too great an abundance, it may prove extremely deleterious.
3. It is used for cold lands. By cold lands are understood clayey or wet grounds.
4. It will much improve the vegetation of fawn grasses, and old pasture, and is equally favourable to the production of corn; the ground, whether grass or arable, being of a cold nature.
5. It is not mixed with lime, or any other substance.
6. The dust is likewise bought by the biglers, and carried to great distances. The nearer farmers likewise fend for the dust in waggon, particularly Mr. Antie, of Dunstable-Houghton, and Mr. Smith, of Sundon, who hold this manure in great esteem.

The following are the experimental hints and remarks of Dr.Pearson on the substance called salt of peat, or dust; which are,
1. That it is a blackish-grey, coarse, and rather heavy powder; has no smell; tastes strongly phytic; readily dissolves in the mouth; did not deliquece on exposure to the air.
2. That it dissolves in four times its weight of water at the temperature of sixty degrees of Fahrenheit, and in twice its weight of boiling-hot water, giving a pale-green coloured solution, with a trifling sediment, which is insoluble in nitric acid.
3. To dissolve (a) he added a little liquid proffix of vegetable alkali, in a perfectly neutral state, which occasioned immediately a most abundant precipitation of proffix of iron; and this stuff was added gradually, till no further precipitation took place.
4. Into the decanted and filtrated fluid (3) was poured liquid, caustic, volatile alkali, but without inducing any change.
5. Into the same fluid (3) was poured liquid carbonate of vegetable alkali, which produced a scarcely perceptible cloudy appearance.
6. Into the solution (3) was dropped the aqueous solution of muriate of barytes, which occasioned immediately a milky appearance.
7. To the solution (3) he added the oxalic acid, and turbidness ensued.
8. A little of the powdery substance called the salt of peat, with concentrated sulphuric acid, produced no emission of fumes or smell.
9. The solution (3) with muriate of barytes, immediately grew thick and white as cream.
10. The solution (3) with carbonate of potash deposited a very copious greenish sediment; and the same effect ensued with caustic volatile alkali.
11. The solution (3) with oxalic acid gave instantly a very turbid, blue-green precipitation.

The preceding experiments, he says, manifest that the melt-salt consists of sulphate of iron, vulgarly called green vitriol of iron, mixed with a very minute proportion of silicious earth and of lime, united either to sulphuric acid, or to carbonic acid. But the presence of the earths, magnesia and argil; the uncombined alkalis, the uncombined acids, are by these experiments excluded. In short, the salt of peat is almost pure sulphate of iron.

Remarks.—1. The salt of peat is, he apprehends, deposited by evaporations which run over the moors where it is found; and hence he should expect many of such waters to be
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be strongly impregnated with it, and in many parts the soil to be tinged red and yellow by ochre. Very likely, on inquiry, much iron pyrites will be found on or near the moors.

This is, says Mr. Willaume, exactly the fact. This sulphate of iron, the salt of peat, during the heat of summer is frequently found in a crystallized state, white, and cracking under the feet; but is deliquescent in that form, and turns to its former dark colour when the air becomes moist.—Note by Mr. J. W. Willaume.

2. The quantity spread on land is said to be fifty bushels per acre, which he estimates at 2250 pounds avoirdupois: this will give nearly seven ounces and a half per square yard. If a larger quantity be applied, it is observed it will prove extremely deleterious. This is true also of every other substance, such as lime, alkaline salts, marine salts, nay of the dung of animals; for if they be used in certain quantities, they poison plants instead of promoting their growth. This is equally true in the animal kingdom; for there is not an article taken as food, or as seasoning, which is not a poison, if taken in certain quantities. A human creature may be poisoned, or intoxicated, by beef or pudding, according to the quantity of them taken into the stomach. He may be poisoned, or have digestion greatly affected, by salt, or pepper, according to the quantity. In fact, the vulgar notion of the term poison is erroneous; for by it is conceived that substances so called are in their nature positively destructive of life; but the truth is, that the most virulent poisons are, in all reason and fact, only deleterious according to the quantity applied. White arsenic swallowed in the quantity of ten grains or less, will destroy life; but in the quantity of one sixteenth of a grain, it is as harmless as a glass of wine; and further, in that dose it is a remedy for invertebrate agues. It is concluded from these considerations, that there is no admittable contradictory evidence to the testimonies for the fertilizing effect of sulphate of iron, unless by such contradicting evidence the quantity stated to be used exceeds fifty bushels per acre; it being an established fact, that in certain proportions this metallic salt is a poison to plants.

Further, it is supposed that this discovery will give new light, so as to explain fully the rationale of the improvement of land by the burnt earth and ashes from peat-bog and burning. It is usual to account for the effects of these processes, by referring to supposed alkaline or other effects; but of these there is no evidence, nay, on trial, he has not detected them, or at least not in any efficient quantity; but this he knows that such earths and ashes contain oxidy of iron, and as such are used in the manufacture of manures. This communication of Mr. Willaume affords evidence, he thinks, of the truth of this conjecture, for the ashes of the peat which affords the salt “have been long known as a manure, and the demand is on the increase;” of course these ashes contain an unusual quantity of oxidy of iron. A consequence of this reasoning is, that the burnt earths of field are, he supposed, containing oxidy of iron in proportion to the oxidy of iron it contains. Accordingly the ashes of the peat, says Mr. Willaume, have a surprising effect; they will double or treble a crop of any new-founo crops, such as trefoil, &c.; and are fo beneficial, that in spite of the expense, they are carried in bags by biglers to a great distance. The doctor concludes by asserting, that the more he contemplates the facts in Mr. Willaume’s letter, the more evidence he perceives for the truth, that metallic salts, and metal oxides in general, and salts and oxides of iron in particular, are manures, if applied in proper doses. He is zealous that it may be understood, that he considers the salt of peat, and the ashes of peat, as operating in promoting vegetation, analogous to sea-soiling, or condiments, taken with food of animals; that is, analogous to mustard, cinnamon, ginger, &c. which are not of themselves at all or scarcely nutritious, but contribute to render other things nutritious, by exciting the action of the stomach and other organs of digestion and assimilation. He has no doubt of the truth of the proposition, that no living thing, neither plant nor animal, can grow and live in a state of visible action without constant supplies of matter which has been alive; in other words, living animals and vegetables can only live on dead animals and dead vegetables. No plant or animal has ever been known by experience, nor in the nature of things does it seem reasonable that they can be nourished by mere water and pure air, as some persons have affirmed.

Also on the other two substances the doctor thus remarks:

2. The Peat.—It is a dense mass of vegetable matter for a certain depth, partly in a dead and partly in a living state, with which is mixed more or less earth; and in burning, it affords so much empirical oil, as to give a disagreeable taste to roasted provisions; hence, as we are told, it has been rejected from the kitchen. The fuel affords a vast quantity of what the chemists call lignic acid; hence it is rejected also from the parlour, as very destructive to grates. He begs to suggest that this lignic acid might be faved in burning the peat as fuel, and be used for various purposes in manufactures; and the charred peat may be used in place of charcoal of wood. Probably, too, other useful products will be found, on examining the matters more accurately which are afforded by distillation.

3. After.—If the peat were mere vegetable matter, the ashes afforded by it would be as trifling as those of wood; but some parts of the moor contain so much earth and oxidy of iron, as to leave behind, on burning, a considerable quantity of incombustible matter; and such kind of peat, we are told, is not used as fuel; but, after burning, the refuse matter is an efficacious manure, much more so than is commonly afforded by paring and burning. The ashes are more red and more fertilizing than ashes of common turf, because they contain more iron.

The spontaneous springing up of white clover in land manured with these ashes, is similar to the spontaneous growth of this plant on heath-land, which has been covered with lime to destroy all its present vegetation; and this fact shows that probably these ashes are buried in the earth for ages, which yet remain alive, but are not set free until exposed to the influence of air, water, carbonic, and lives the animal or vegetable matter. And other facts discovered by respectable chemists are added, which serve to show that other facts, beside sulphate of iron and certain earths, may be employed advantageously as manures, although, like iron, they have been esteemed deleterious to plants.

1. Ashes of pit-coal are a good manure for græs. It is stated in the fourth volume of Nicholson’s Journal, that he much valued friend, the Rev. William Gregor of Grampound, on examination of the ashes which are sold in Liverpool, found them to contain both sulphate of magnesia and sulphate of lime, especially the former salt. He apprehends that these ashes also contain oxidy of iron, or perhaps sulphate of iron. These ashes, says Mr. Gregor, “advanced” over græs, apparently produced good effects, notwithstanding the sulphate of magnesia, which he was well assured they contained. On this it is remarked, that from this observation of Mr. Gregor, it seems he is aware of the prevailing popular opinion, that sulphate of magnesia is not favourable to vegetation; and to reconcile his facts with the unfriendly nature of magnesia to plants, as discovered by Mr. Tennant, he observes,
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observes, that the effects of sulphate of magnesia may be very different from those of magnesia and carbonate of magnesia. He apprehends it is the magnesia (calcined till urine, as to which this learned chemist found it harmful to vegetables, as the discovery was made on the examination of Notting-ly lime, which the farmers near Doncaster employ as a manure, while they reject the lime of their own neighbourhood. In the latter Mr. Tennant met with magnesia, and in the former none. See LIME.

2. The earth from ashes, called cinia, is a durable and efficacious manure. It is observed, that professor Mitchell, of New York, in a letter addressed to Dr. Pearlion on cinia, says, that he found in the ashes of wood, a plant, remarks, that the ashes of wood contain very commonly sulphate of potash, also phosphoric acid, besides other well-known facts; but after these facts are separated by lixiviation, there remains a peculiar earth, and a small proportion of iron. This earth differs from lime, barites, magnesia, fiesontain, and very other known species of earth. He would call it cinia, for plenti-ful, common, and important as it is, science has not digni-fied it with a name. To judge of the excellence of this earth as a manure, after all the facts are extracted from foap-boat ashes, the earth falls for ten cents the bushel; and notwithstanding this high price, it is not unusual for the farmer to pay for the article twelve months before-hand. When ploughed into fertile ground, at twelve loads per acre, it produces great crops of wheat, clover, and other forts of grass and grain, and its fertilizing operation will last twenty years. Although some of the other ingredients of the ashes left after lixiviation may prove beneficial, yet the effects are chiefly from the cinia, or new-named earth.

This earth, which is so prized in America as a manure, was, it is said, esteemed of old in Asia, as an ingredient in a cement among the ancient Syriants, it was one of the materials forming the plaster of their walls; and as it holds an intermediate place between lime and potash, it can easily be conceived how it may act both as a cement and a manure. It is to be hoped chemists will turn their attention to this important subject. See vol. vii. of Tilloch's Philosophical Magazine.

4. Sulphate of iron in the pest of Ruffia. This was found by professor Robison. And it is observed, that sometimes the pest of vegetable matter is necessary to form peat or black mould of vegetable matter, but the peat is different from that of vegetable matter. Peat-ashes, says the professor, always contain a very great proportion of iron: he has seen three places in Ruffia where there is superficial peat-mofs, and in all of them the vitriol is so abundant as to effloresce. In particular, on a moor near St. Peterburgh, the clods threw the vitriol (sulphate of iron) every morning when the dew has evaporated. According to this learned professor's observations, the sulphate of iron in peat-coal may be accounted for in the following manner: peat-mofs form very regular strata, lying indeed on the surface; but if any operation of nature should cover this with a deep load of other matter, it would be compressed and rendered very solid; and remaining for ages in that situation, might ripen into a sublimate very like peat-coal. See Medical and Chirurgical Review for November 1803.

5. Use of peat-dui and peat-ashes. In answer to a letter from Dr. Pearlion, requesting to know what experiments Mr. A., had made from the turf-dui taken from The same moor he affords the testimony of having made use of the ashes and duii near thirty years, and frequently laying on from eighty to a hundred bushels per acre. Our land, says he, is dry and very thin-flapped, owing to the chalk-rock lying very near the surface: it encourages vegetation in moist warm weather, but when hot and dry, the reverse. We never mix any other manure with it. It costs about four cents per bushel, including all expenses. We chiefly spread it over feed, grass, clover, &c.

In addition to these useful and interesting statements, it may be noticed, that the able writer of a late work on Agricultural Chemistry, has witnessed the fertilizing effects of a ferruginous water used for irrigating a graft meadow made by the duke of Manchester at Priesty Beg, near Woburn, in Bedfordshire, an account of the produce of which has been recorded in some of the Publications of the Board of Agriculture. It is not doubted that, in this case, the peat-flat noticed, also, that vitriolic water acted chiefly by produc- ing the sulphate of lime, or a sublimate of that nature. It is observed, that the soils on which both are efficacious, are those of the calcareous kind, and that sulphate of iron is decomposed by the carbonate of lime in such soils; that the sulphate of iron confits of sulphuric acid and oxtyd of iron, and is an acid and very soluble salt; that when a solution of it is mixed with carbonate of lime, the sulphuric acid quite the oxtyd of iron to unite with the lime; and that the compounds produced are infelid, and comparatively infelid.

Some of the depots from the ferruginous water on the soil of the above meadow was collected, and it was found that it consisted of sulphate of lime, or a sublimate of that fort, carbonate of iron, and infelid sulphate of iron. The principal grafts in the above meadow are, it is said, the iron, fox-tail, cock's-foot, meadow fescue, heroine, and sweet-infelid vernal grafts. The ashes of three of these grafts, as the meadow fox-tail, cock's-foot, and hor, have been examined, and found to contain a considerable proportion of sulphate of lime, or a sublimate of that kind.

This knowledge of the nature, formation, and use of this sublimate, may lead to many useful improvements in soils which contain it, or the matters of which it is composed, as well as to more suitable and proper appli-cations for them in the way of manure, and to better and more advantageous methods of using and applying them.

SULPHATE OF IRON, DRIED, of the Edinb. Ph. is prepared by heating any quantity of sulphate of iron in a close glass vessel, until it becomes white, and perfectly dry. The process is nearly the same in the Dub. Ph. The degree of heat in these processes should not exceed 212° of Fahrenheit. Its official proportion is the "red oxtyd of iron," which is rarely used, except as a pharmaceutical agent. See IRON.

SULPHATE OF KALI. See SULPHATE OF Potash.

SULPHATE OF Lime. See Gypsum, Sulphate of Lime, and Salts.

According to lord Dundonald, sulphate of lime exists in great abundance in many soild. It is produced by the decomposition of aluminous schist, containing a due proportion of calcareous matter; with which the sulphuric acid will join, as it is formed, in preference to the earth of alum or clay. It is likewise formed by the decom-posion of pyrites in such soild as contain a sufficiency of calcareous matter for the sulphuric acid to combine with, in preference to the earth of iron, the other constituent part of pyrites.
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Sulphate: and it is found in immense quantities, constituting not only the soil, but the subsoil, in some countries, to a great depth. It is to be decomposed by alkaline salts; the sulphuric acid forming with them sulphate of potash and sulphate of soda, according to the alkali used. It is a salt very insoluble, requiring upwards of five hundred times its weight of water to dissolve it; hence, supposing it equally deleterious to vegetation, as alum hath been considered, which is soluble in only fifteen times its weight of water, it must, he says, prove less injurious, from its greater degree of insolubility; but this substance, far from being hurtful to vegetation, when applied to certain soils, promotes it in a very high degree, as is evinced by the use of it in some parts of the continents of Europe and America; and it is further proved by the chemical analysis of vegetables, whereof ashes are found to contain a certain portion of the component parts of it.

Sir Humphrey Davy, in his work on "Agricultural Chemistry," observes, that calcareous matter, besides being used in the forms of lime and carbamate of lime, is applied for the purposes of agriculture in other combinations; one of which is the compound substance which is that of sulphate of lime. That was material composed of sulphiure of lime and the same body that exists combined with water in oil of vitriol and lime; and that when dry, it is composed of fifty-five parts of lime, and seven-five parts of sulphuric acid. That common sulphate of lime, or feline, such as that which is found at Shotover-hill, near Oxford, contains, besides sulphuric acid and lime, a considerable quantity of water; and the composition of which may be expressed and explained somewhat in this manner. Sulphuric acid one proportion, seventy-five; lime one proportion, fifty-five; and water two proportions, thirty-four.

The nature of this sulphate is, it is said, easily demonstrat'd; when oil of vitriol is added to quick-lime, there is a violent heat produced; and when the mixture is ignited, water is given off, and this sulphate alone is the result, if the acid has been used in sufficient quantity; and this sulphate mixed with quick-lime, if the quantity has been deficient. This substance, free from water, is sometimes, it is said, found in nature, in which case it is called by hydrous feline. It is distinguished from the common sulphate, by giving off water when heated. When this sulphate, free from water, or deprived of it by heat, is made into a paste by the same fluid, it rapidly sets, it is said, by combining with that liquid. Plaster of Paris, it is observed, is powdered dry sulphate of lime; and that its property as a cement, and in its use in making casts, depends upon its solidifying a certain quantity of water, and forming with it a coherent mass. Sulphate of lime is soluble in about five hundred times its weight of cold water, and is still more soluble in that which is hot; so that when water has been boiled in contact with this sulphate, crystals of it are deposited as the water cools. Sulphate of lime, too, is easily distinguished, it is said, by its properties of affording precipitates to solutions of oxalates, and of barytie salts.

There has long been much difference of opinion prevailing among farmers and agriculturists in respect to the use of this substance on land. It is said to have been had recourse to with much advantage and in some few districts of this country; and a variety of strong testimonies in favour of its power and efficacy, when laid on land, has been brought to the notice of the Board of Agriculture by Mr. Smith. In America, too, it is stated to have been employed with signal success, especially in some provinces; but in many other counties of this kingdom, it is said to have failed, though tried in various ways, and upon different kinds of crops. It is remarked, that very discordant notions have been formed as to the manner in which this substance operates. Some have supposed it to act by its power of attracting moisture from the air; but this agency, it is thought, must be comparatively insignificant. When combined with water, it retains that fluid too powerfully to yield and supply it properly to the roots of the plants; and its adhesive attraction for moisture is inconsiderable: the small quantity in which it is used, is likewise, it is supposed, a circumstance hostile to this idea. It has been said, too, that this substance afflicts the putrefaction of animal matters, and the decomposition of manure; but some experimental trials have been made on this subject, which are in contradiction to the notion. On some minced veal being mixed with about one-fourth of its weight of this sulphate, (some veal without the sulphate being exposed at the same time and under the same circumstances,) there was no difference, it is said, in the time in which they began to putrefy; but the results appeared to be more rapid in the case in which there was no sulphate present. Other similar mixtures were made, in which in some cases larger, in others smaller, quantities of sulphate were employed; and in one instance, pigeon's dung was used instead of flesh, and with precisely similar results. It certainly, in no case, it is said, increased the rapidity of putrefaction.

A series of experiments, it is said, has been carried on for a great length of time in this country, upon the operation of this sulphate as a manure, though it has not been generally known; as the Berkshire and Wiltshire peat-ashes contain a considerable portion of this substance. In the Newbury fort, from one-fourth to one-third of this sulphate has been found, and a still larger quantity in some from the neighbourhood of Stockbridge, besides other constituent matters. These very substances are much in use for top-dressing cultivated grasses, particularly fai-fains and clover. In examining the ashes of these two, and those of rye-grafs, it was found that they afforded considerable quantities of this sulphate, and that this substance, probably, is intimately combined as a necessary part of their woody fibre. If this be allowed, it is suppoed easy to explain the reason why it operates in such small quantities; for the whole of a clover, or of a fai-faine, on an acre, would it be said, on the average which has been made, only afford, by incineration, three or four bushels of this sulphate. In examining the soil of a field near the above town, which was taken from below a foot path, where this sulphate could not have been artificially furnished, not any of this sulphate could be detected it; yet at the very time the soil was collected, the peat-ashes were applied to the clover in the field. The reason why this sulphate is not generally efficacious is, probably, it is suppoed, because most cultivated soils contain it in sufficient quantities for the use of the grasses. In the ordinary course of cultivation, this substance is, it is said, furnished in the manure; as it is contained in flabile dung, and in the dung of all cattle and animals feeds on grass; but it is not taken up in corn crops, or those of peas and beans, and in only very small quantities in turnip crops; however, where lands are exclusively devoted to paiturage and hay, it will, it is said, be continually consumed.

Four different foils cultivated under a series of common course of crop, have, it is said, been examined for this sulphate: of which, one was a light sand from the county of Norfolk; another a clay, bearing a good wheat, from that of Middlesex; the third, a sand from Suffolk; and the
the fourth, a clay from Essex. In all of them this sulphate is rated to have been found; and that in the soil from Middlesex it amounted to nearly one per cent. The writer, too, has been informed by Lord Dandans, that, having tried this sulphate on two of his estates in Yorkshire without any benefit, he was induced to have the foils of them examined for this sub stance, in the manner directed in speaking of foils, in both of which this sulphate was found. See Soil.

It is thought, that if these reasoning and statements should have the confirmation of future inquiries, a practical inference of some value may be derived from them; which is, that it is possible in March, in which have ceased to bear good crops of clover, or other artificial forage, may be restored by being manured with this sulphate.

It may be noticed, that, in addition to the place already mentioned where this substance is found, it also abounds pretty much, it is said, in many other parts of this country; as in Gloucestershire, Somersetshire, Derbyshire, Yorkshire, and some others, and only stands in need of pulverization, in order to prepare and fit it for being applied to the land.

It may be remarked, that although the ashes of certain peas, as seen above, afford sulphate of lime, it is not, it is said, to be concluded from that that all peas agree with them, as some which have been examined contained no quantity that could be useful; and abounded with injurious matters. Vitriolic matter is, however, usually formed in peas; and where the soil or substratum is calcareous, the ultimate result is the production of this sulphate. In general, when a recent ash of this sort emit, when acted upon by vinegar, a strong smell, like that of rotten eggs, it will, it is said, furnish this sulphate.

In Oxfordshire, in some cases, this substance has been found over clover in March, in which have ceased to bear good crops of clover, or other artificial forage, may be restored by being manured with this sulphate. In general, when a recent ash of this sort emit, when acted upon by vinegar, a strong smell, like that of rotten eggs, it will, it is said, furnish this sulphate.

In Kent, when found over a large part of a field of lucern, and a part left without any, the superiority of the part found with it was very great. In Suffolk, it has been found on portions of natural grasses, beans, potatoes, peas, barley, wheat, red clover, and tares, in moist weather, at about eight bushels, and in the above quantity to the acre, on sandy loam, and open, without any perceptible effect, where the same or the following year, being produced by it. This would seem to show that this land, in so many instances, is so much impregnated with it as to stand in need of no more for giving luxuriance to the plants upon it.

**Sulphate of Magnesia.** See Magnesia, Epsom Salt, Salt, and Salts.

By Dr. Home's experiments, sulphate of magnesia has been found in a very high degree to promote vegetation. He states, that it made the garden-mould be used for his experiments produce one-fourth more grain.

Sir Humphrey Davy, however, thinks, that though this substance has been flattered by some inquirers to have been found useful as a manure, it is not met with in nature in sufficient abundance, or capable of being made artificially in a sufficiently cheap manner, to be of useful application in the common course of husbandry and management of land. See Magnesia, in Agriculture.

**Sulphate, Ammonio-Magnesian,** a triple salt, compounded of sulphuric acid, magnesia, and ammonia, by adding pure ammonia to sulphate of magnesia, in which case a great part of the earth is precipitated, and the rest remaining in solution, the salt is formed by evaporation. It is also procured more speedily, and with less loss, by adding to a solution of sulphate of magnesia one of sulphate of ammonia, each somewhat concentrated. An abundant deposition of regular, transparent, thinning crystals takes place immediately, which are the triple salt in question: its form is generally octahedral; its taste is salt and bitter. When heated, it first melts in its own water of crystallization, after which it is decomposed, ammonia is first given out, then acidulous sulphate of ammonia rises, and simple sulphate of magnesia remains.

This triple salt is much less soluble in water than either of the sulphates of which it is formed, as is obvious by its precipitating on the addition of the two solutions. According to Potters, it is saturated in per cent. of sulphate of magnesia, and 1% of sulphate of ammonia.

**Sulphate of Potash.** See Salts.

This saline substance has been found by Dr. Home to promote vegetation in an extraordinary manner. The garden-mould on which his experiments were made, produced an increase of one-fourth more grain, in consequence of the application of this salt. It is to be had from most vegetable matters by combustion; it forms at least one-third of the saline matter obtained by the lixiviation of their vegetation. This is sufficiently, it is said, a proof, independent of Dr. Home's experiments, that vitriolated tarter is beneficial to vegetation. This substance is a refuse article in some branches of manufacture; but the quantity produced is a mere trifle, in comparison to the quantity that might, it is thought, be advantageously applied to the purposes of agriculture.

This sulphate, which is found in the ashes of some peas, as those of Berkshire, is certainly an useful substance as manure, though the results of Dr. Home's trials have been questioned by Mr. Nasmith, in his elementary work on agriculture; who has pointed out experiments which he considers as hostile to the doctor's opinions and conclusions, and as unfavourable to the power and efficacy of any sort of substance of this kind.

Sir Humphrey Davy has found the effects of this sulphate to be much the same on the growth of plants of the grain and grass kind, when employed in large and small proportions, as those of the sulphate of ammonia: which would seem to shew, that the effects are different according to the quantities made use of, and that large quantities are unfavourable.

**Sulphate of Soda.** See Salts and Soda.

From experiments, sulphate of soda has been proved to promote vegetation in a very high degree. It is procured in small quantities, in the processes for making the muriatic acid, and muriate of ammonia, or sal ammoniac. The high price at present of this article precludes the use of it; but could it be made and sold at a cheap rate, it would, as Lord Dundonald thinks, prove a most valuable acquisition to agriculture. Sir Humphrey Davy has found that the effects which it produces, when used in different proportions for plants of barley and grass, are much the same as those of sulphate of ammonia.

**Sulphate of Strontian.,** a salt without taste and smell; nearly insoluble in water; not decomposed by any single acid; but barytes, alone or in combination, abstracts its acid, with which barytes has the greater affinity. It is also decomposed by the carbonate fixed alkalies, and with much more ease in the moist way than the sulphate of barytes. Sulphate of strontian, like the barytic sulphate, is readily soluble in sulphuric acid, and precipitable thence by dilution with water. This salt is decomposed by fusion with charcoal into a sulphuret. For the analysis of the native sulphate, see Strontian.

**SUL-**
SULPHITE.

SULPHITES, salts formed by the combination of any base with the sulphurous acid. N.B. All salts that are composed with acids whose names end in -ite, terminate in -ite, instead of ate. These salts have always a disagreeable sulphurous taste; they are decomposed by the nitric, muriatic, and some other acids, which do not affect "salts": if exposed to fire, they yield sulphur, and become sulphates; and even by mere exposure to the action of the atmosphere, they are converted into sulphates. The principal of these salts are the following: viz.

Sulphite of Alumine, formed from pure alumine. It is in the state of a white soft powder; sweetish to the taste, and then sulphurous; insoluble in water, but taken up by an excess of acid; not crystallizable. It is decomposed, according to Dr. Thomson, of

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<tr>
<th>Component</th>
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<tbody>
<tr>
<td>Sulphurous acid</td>
<td></td>
<td>32</td>
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<tr>
<td>Alumine</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>Water</td>
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but applicable to no use. See ALUMINE.

Sulphite of Ammonia, prepared by faturating a solution of caustic ammonia with gaseous sulphurous acid. See AMMONIA, AND SALTS.

Sulphite of Barites, may be prepared with either pure barites, or the carbonate reduced to a fine powder; or it may be obtained, by compound affinity, from a mixture of an alkaline sulphite with muriate of barites. It is in the form of a white powder, tafteafte, and insoluble in water. By long exposure to the air, it is converted into sulphate of barites. When strongly heated, sulphur is diffused, and the residue becomes sulphate. This salt may be dissolved in liquid sulphurous acid, and by slow evaporation, may be obtained in needle-formed crystals, or truncated tetrahedrons. These crystals are sometimes transparent, but often opaque; nearly infinid, and leaving on the palate a sulphurous flavour; sparingly soluble in water; and the solution is advantageously employed for purifying the sulphites from any mixture of sulphate. According to Fourcroy, the crystallized sulphite consists of

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<tr>
<td>Barites</td>
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<td>59</td>
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<tr>
<td>Sulphurous acid</td>
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<td>39</td>
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<td>Water</td>
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It is decomposed by the sulphates; by the alkaline phosphates; by the nitrate and muriate of flourian; and by the alkaline carbonates. See BARITES.

Sulphite of Lime. See LIME.

Sulphite of Magnesia, is prepared with carbonated magnesia, diffused in twice its weight of water; it is in the form of powder, but by an additional portion of sulphurous acid, readily diffores; and by gradual evaporation, is deposed in the form of transparent, deprived, tetrahedral pyramids. To the taste it is at first sweetish and earthy, and afterwards sulphurous; exposed to the air it becomes opaque, and is slowly converted into a sulphate. It is soluble in twenty parts of water at the common temperature; boiling water takes up an additional portion, which it deposits in crystals on cooling. When exposed to a dry heat, it cools, and assumes the consistence of a vitific gum, and at length dries, having lost 45 per cent., which is nearly pure water; at a higher heat the sulphurous acid rises unaltered, and the earth remains behind. From this mode of analysis it appears, according to Fourcroy, to consist of

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<tr>
<td>Sulphurous acid</td>
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<td>39</td>
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<tr>
<td>Magnesia</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Water</td>
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<td>45</td>
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It is decomposed by the alkaline and earthy-alkaline carbonates; by the sulphates of alumine and zircon; by the earthy nitrates; by the phosphates of the alkalies, and of lime, glycine, alumine, and zircon; and the alkaline borates. It is not applied to any use. See MANGENIA.

Sulphite, Ammonico-Magnesian, a salt formed, according to Fourcroy, by mixing magnesia with sulphite of ammonia, or ammonia with sulphite of magnesia, or by adding together the two sulphites. It occurs in the state of small transparent indeterminate crystals; it is lees soluble in water than either of the two sulphites separately, of which it is composed. Exposed to air it changes into the triple sulphate of ammonia and magnesia. When heated, it first gives out sulphurous acid, then acridulous sulphite of ammonia sublimes, and pure magnesia remains behind. The proportion of its constituent parts has not been ascertained. It is decomposed by barites, flourian, lime, and the fixed alkalies. It is not used.

Sulphite of Potash, is most conveniently prepared by connecting a retort, charged with sulphuric acid and mercury, with a Woulfe's apparatus of two bottles, the former of them containing a little water, and the latter about two-thirds filled with a solution of crystallized carbonate of potash, in thrice its weight of water. The retort being heated, sulphuric acid gas is produced, which passing through the water in the first bottle, is thereby purified from any contamination of sulphuric acid, and then enters the alkaline solution in the next bottle, by which it is rapidly absorbed, carbonic acid gas escaping in bubbles at the same time. When the effervescence has ceased, and the sulphurous acid is no longer taken up by the liquor, the procés is finished, and the liquor, as it cools, generally deposita crystals, if the above proportions of alkali and water have been observed.

Sulphite of potash, thus prepared, is a transparent salt sometimes colourless, but often with a slight yellowish tinge. It crystallizes either in the form of lengthened rhomboidal plates, or divergent needles. To the taste it is pungent and sulphurous; its specific gravity is 1.58; it is readily soluble in its own weight of water, at the common temperature, and in a much smaller quantity of boiling water. If this solution be exposed to the air, it will be covered in a short time with a crystalline pellicle; when this falls to the bottom, it is succeeded by another, and so on, till the whole is converted into sulphate of potash. By an exposure to a temperature of about 300° Fahr. sulphite of potash loses about 22 per cent.; of which 15 are sulphurous acid gas, 5 are sulphur, and 2 water: the salt that remains being sulphate of potash, with a slight excess of alkali. If it be rapidly ignited in a platina crucible, when the decr iptation ceases, a blue flame makes its appearance, occasioned by the combustion of the alkali, after which the salt is found to have lost 22 per cent. as before. The component parts
SULPHUR.

parts of this salt, according to Dr. Thomson's analysis, are

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<tr>
<td>Sulphurous acid</td>
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<tr>
<td>Potash</td>
<td>54.5</td>
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<td>Water</td>
<td>2.0</td>
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This, as well as other sulphites, is most conveniently analyzed in the following manner: first, alay the solution with sulphite of barytes, to ascertain whether any mixture of sulphate is present, and having thus got rid of the sulphuric acid, add nitrate of lead as long as any precipitate falls down. The sulphite of lead, thus obtained, confits, according to Dr. Thomson, of 25 per cent. sulphurous acid, and 75 yellow oxyd of lead.

Nitric acid converts this salt into sulphate of potash: oxynuratic acid produces a similiar effect, driving off at the same time a portion of sulphurous acid, so that the resulting sulphur is mixed with a little muriate. It is also converted into sulphate by the oxys of gold, silver, mercury, the red oxyd of lead, and the black oxyd of manganese. It is decomposed, by compound affinity, by all the earthy and alkaline sulphates, except sulphate of barytes; by the nitrates, with the exception of nitrate of ammonia; by the muriates, except muriate of alumine; by the phosphates of soda, ammonia, alumine, and glycine; by the fluorites of soda, ammonium, barytes, frontian, and magnesia; by carbonate of soda, and by all metallic salts except the carbonates. It has not been applied to any use.

SULPHITE of Soda, is prepared from carbonate of soda, in the same manner as sulphite of potash is from carbonated potash. At first it is a confusedly crystallized mass, and this, by subsequent solution in hot water, affords, on cooling, very regular distinct crystals, in the form of compressed tetrahedral prisms, with dithedral summits. Its specific gravity is 2.95. Its taste cooling and sulphurous. It is soluble in four times its weight of water, and in less than its own weight of boiling water. It effloresces on exposure to the air, and becomes covered with a white crust, but does not fall into powder as sulphate of soda does. When heated, it first melts in its water of crystallization, and on increasing the temperature, undergoes changes analogous to those described in the preceding article. According to Dr. Thomson, it is composed of:

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<tr>
<td>Sulphurous acid</td>
<td>31</td>
</tr>
<tr>
<td>Soda</td>
<td>18</td>
</tr>
<tr>
<td>Water</td>
<td>51</td>
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<td>100.</td>
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It is decomposed by the alkaline and earthy sulphates, with the exception of the sulphates of barytes and soda; by the earthy nitrates; by the ammoniacal earthy muriates, phosphates, and fluorites; by the borate and carbonate of potash; and by most of the metallic salts. It has not yet been applied to any use. Akin.

SULPHUR, in Mineralogy, an inflammable mineral, which burns with a blue flame and a peculiar suffocating odour, and has almost always a yellow colour. By these characters it may be easily distinguished from every other mineral. Sulphur has been considered as the product of volcanic fires, and the greatest part of the sulphur of commerce is obtained from the vicinity of volcanoes; but sulphur, either pure or combined with oxygen, enters largely into the composition of numerous metallic and earthy minerals, and may be said to form a component part of the globe itself. Sulphur, combined with iron or iron pyrites, is widely and abundantly distributed through many of the strata. (See PYRITES and STRATA.) Sulphur, combined with oxygen or sulphuric acid, unites with lime and forms gypsum, which exists in beds and strata of considerable extent. (See GYPSUM.) In almost all metallic veins we meet with combinations of sulphur, and in beds of coal, and in bituminous wood. Pure native sulphur is emitted in great quantities from volcanoes, and hence we may infer that this mineral exists abundantly in the interior of the earth. It exists also in a gaseous state combined with hydrogen, and is absorbed by water, giving to it peculiar properties. See WATERS, Mineral.

Native sulphur is divided by Werner into two kinds, common sulphur and volcanic sulphur. They are principally distinguished by the different situations in which they occur, being essentially the same. The colour of common sulphur is yellow, which sometimes inclines to greenish or grey. It occurs in nodular masses, and crystallized, in acute double four-sided pyramids, forming octohedrons, and also in double fix-sided pyramids. The crystals present several varieties by truncation of the points or edges. The octohedron, according to Hauy, is the primitive form of the crystal. The crystals are rarely perfect (those from Sicily are the best, and are sometimes five inches in length); they are translucent and sometimes transparent, and polishes in a remarkable degree the property of double refraction; they are soft, brittle, and easily broken; the lustre is more or less shining, between resinous and adamantine. Native sulphur is negatively electric by friction; its specific gravity is 1.99. It melts easily, and burns with a blue flame. If sulphur be suffered to cool slowly after melting, and a part of it be poured off, the remaining solid part will be found covered with minute capillary crystals of no determinate form, having no analogy with the form of the native crystal.

Massive native sulphur is both opaque and translucent, and has sometimes a rough and sometimes a conchoidal fracture, and generally a shining lustre.

Native sulphur is also disseminated in small fragments in different stones; it sometimes forms a powdery incrustation over other minerals. Native sulphur occurs both in primary and secondary rocks, but more abundantly in the latter. Sulphur very frequently accompanies rock-fault and gypsum, and may be considered as more particularly associated with them than with any other minerals that are not volcanic. It often forms beds in the marie and shale which cover or alternate with gypsum. Native crystallized sulphur has been found on the under surface of coal beds, near whin-lykes, in the county of Durham. Sulphur occurs in the torm of powder in the strata subjacent to coal in Derbyshire, and has sometimes been found massive in Anglesea.

Native sulphur also occurs in veins which traverse some of the mountains in Hungary, composed of giesis and mica-flate. M. Humboldt mentions as an extraordinary fact, the existence of sulphur in a bed composed of quartz, passing into hornstone, and traversing a mountain of mica-flate, in the great mountain of sulphur in Quito, between Alausi and Tician, and describes two other repositories of sulphur in primitive porphyry. Sulphur is found on the surface of the ground in beds of considerable thickness, deposited by waters holding sulphuretted hydrogen gas in solution. These repositories of sulphur, according to Pallas, are very common in Siberia; some of them furnish a sufficient quantity to be worked with advantage as sulphur-pits. The fame naturalist says, that on the north of the Caspian sea, and
SULPHUR.

to the south of Saporiva, in Siberia, there are marbles and even rocks which deposit great quantities of sulphur, with some carbonate of lime. Other waters, such as the warm springs of Aix-la-Chapelle and Tivoli, deposit sulphur; and we have seen a similar deposition from the mineral springs near Llandegley, in Radnorshire. The sulphur forms a white pellicle on the water, and is deposited on the stones at the bottom and sides of the spring. It has been discovered in cressets, horse-radish, and several other vegetables. It is also evolved from animal subfusces, during their putrefaction, in combination with hydrogen.

Volcanic sulphur is far more abundant than common sulphur; its colours are various shades of yellow, inclining to orange and red. It is found sulfured in small crystals in beds, or in a state of powder in the cavities of lava, contiguously to the craters of volcanoes. It is sometimes mixed with decomposed lava. Sulphur is the product of all active volcanoes; but the most remarkable sulphuriferous, or sulphuriferous reporitories, in Europe, are in Italy, Sicily, the Lipari islands, and Iceland. Solfataras, near Pozzuoli, in the kingdom of Naples, is an oval plain about two hundred yards in diameter, surrounded by steep rocks on all sides, which are perpetually decomposing and falling down in ruins. The plain is elevated about two hundred and fifty yards above the level of the sea, and is regarded as the crater of an ancient volcano. The plain is feebly hotter than the atmosphere in the warmest days of summer, and burns the feet through the shoes. Vapour and steam rise from almost every part of the plain to a considerable height. This vapour has the odour of sulphur, and it forms on the sides, and in the crevices of the rock, large masses of mafrous sulphur. In the middle of the plain there is a kind of basin, three feet lower than the rest of the surface, which forms hollow when any person walks over it, as if there was a great cavern beneath. Further on is a small lake, called Agrano, the temperature of which is below that of boiling, but it is in a state of constant ebullition, from subterranean vapours which rise through the water. Beyond this lake are the excavations from whence the earth is dug which furnishes the sulphur; it is light and tender. From the crevices in this part, the vapour which exhales is accompanied with a noise. The workmen always dig into the plain for the earth, and neglect the sulphur, which is formed on the surface in considerable quantities, and of a bright yellow colour. They say the latter has lost its nature, and does not make sulphur of so good a quality as that which is procured from the soft stone under the surface.

Ever since the days of Pliny, the Solfataras has supplied a considerable part of the sulphur of commerce in Europe. According to M. Breislak, the sulphur is formed by the decomposition of sulphureted hydrogen gas, which is plentifully diffused in this place. See SOLFATARAS.
The sulphur is extracted from the earth with which it is mixed by sublimation. The earth containing it is put into earthen pots, placed in two rows in a long furnace. These communicate with other pots of a similar kind, placed on the outside of the furnace, by an earthen tube: the outer pots have an aperture at the bottom stopped by a peg, and a smaller aperture at the top, to let out the vapour. The sulphur in melting passes with a hissing noise into the second vessel; under this is placed a bucket filled with water, into which the melted sulphur flows when the peg is withdrawn, and instantly becomes solid. It is melted again, and cast into wooden cylindrical moulds, forming roll-sulphur. Volcanic sulphur occurs also in other parts of Italy, in Sicily, the Lipari islands, and in Iceland. It is found indeed in all volcanic countries and islands. The West Indian islands in which it is obtained, are St. Domingo, St. Lucia, Martinique, Guadaloupe, and St. Vincent's. The volcanic sulphur in the Cordilleras of Quito is abundant, and of the purest quality.

Volcanic sulphur is purer than the sulphur obtained from pyrites; the latter is almost invariably mixed with arsenic and other metallic matters, on which account the sulphuric acid made from it is improper for many manufactures, particularly for the preparation of the bleaching liquid.

Mr. Sylvestre has collected small specimens of crystallized sulphur, formed by sublimation, at Bradley, near Wolverhampton. At that place a bed of coal has been for many years on fire. This heat has had the effect of subliming sulphur from the iron pyrites, which condenising among the cinder and other refuse on the surface, is found in an efflorescent form of a bright yellow colour. Muriates of ammonia is frequently found in the same situation in a sulfured form.

Sulphur is obtained in large quantities, at a small expense, from the pyrrhotine copper-ores during the roasting which this undergoes previous to the process of fusing. At the celebrated Pyres mine in Anglesea, works for this purpose are constructed on a large scale. At the foot of a low but steep ridge of rock, are constructed maffles of masonry, not unlike high blast-furnaces, except that the top is capped with a dome of brick-work, from which proceeds a horizontal flue, about the size of a common chimney, which terminates in a square or oblong brick chamber, built at the top of the rock. Some lighted fuel is introduced by means of a door in the dome of this roasting furnace, and a few basketfuls of ore, broken into moderately small pieces, are thrown on it, fresh parcels of ore being added from time to time, as the preceding parcels get lighted; a sufficiency of air for the slow combustion required in this process, is lent by means of a door at the bottom of the kiln, which also serves to take out the ore by when properly roasted: that part of the sulphur which escapes combustion rises in vapour, and collects in the dome (the door of which is only opened to admit fresh charges of ore), whence it passes through the flue into the chamber, where it presently concretes, lining the sides and roof; each chamber has a door, by means of which about once in five weeks, it is cleared of the sulphur. This rough sulphur is in fuffy pulvulent crusts, of a dirty greyish-yellow colour. For its purification it is melted in a boiler, the impurities are got rid of by scumming and subfusces, and the fluid mass is then laded into cylindrical moulds, to form the common roll-sulphur or brimrose, or into cones about two feet high, forming the loaves of sulphur. The impure drags are also sold in the shops under the name of sulphur visum.

Besides the common sulphur, there are two other forms in which this substance appears in commerce, namely, the sulfured, or flowers of sulphur; and the precipitated, or magallery of sulphur.

Flowers of sulphur are prepared in the laboratory, by heating in a land-bath an earthen cucurbit charged with roll-sulphur, and surmounted by a jet of aludels; at a gentle heat the sulphur frits melts, then rises in vapour, and concretes within the aludels in the form of a glittering yellow powder, which, when examined by a microscope, appears to be composed of minute crystals. Flowers of sulphur are made in the large way by conducting the vapour of melted sulphur into close chambers instead of aludels, and being prepared with less care, it is often inferior in purity to that obtained by the former method. Flowers of sulphur, however prepared, are more or less seidulous from a mixture of 3 R 2 sulphurous.
SULPHUR.

fulphurous acid, on which account, an infusion of them in water reddens tincture of litmus; this acid, however, may easily be got rid of by washing the powder first with a warm and very dilute solution of pearl-ash, and then with two or three successive parcels of warm water.

Magpyery of sulphur is prepared by decomposing by the fulphuric or any other acid a solution of alkaline sulphuret; a proper bleed precipitate falls down, which is to be thoroughly edulcorated with successive parcels of warm water. Sulphur in this state has a dull earthy appearance, owing to its extremely minute flake of division; it is of a yellowish-white colour, is smooth and almost incipient to the touch; by exposure to light it acquires a yellow colour. It is generally looked upon as the purest form of sulphur, yet from some of its properties, and the mode in which it is prepared, there is some reason for supposing that a portion of hydrogen enters into its composition.

The sulphur that is procured in the roasting of ores, especially those of copper, is apt to contain, besides earthy impurities, a very notable proportion of arsenic, while on the other hand the volcanic sulphur in general, and that of Sicily in particular, is entirely free from this contamination. This is the cause of the universal preference given by the manufacturers of fulphuric acid to Sicilian, over English sulphur; and hence it is a matter of some consequence to be able to ascertain, in a compendious and satisfactory manner, the purity of any particular sample of this substance. The following method will, we believe, be found to answer every practical purpose. Having rubbed to fine powder in an earthenware mortar some of the sulphur to be examined, take 100 grains, and put them into a Florence flask with five ounce-measures of the beet oil of turpentine; heat the mixture gently over a lamp, or a pan of charcoal, till it has boiled for about a minute, then pour the clear hot solution into a fix or eight-ounce vial, fill it with a cork, and shake it till the liquor has cooled down to the temperature of the hand; it will now be quite turbid with sulphur that has separated from the oil during its cooling, and being run through a glass funnel very lightly plugged with fine tow, will pass out clear, leaving the sulphur behind. The oil is now to be again transferred to the sulphur remaining in the flask, and to be a second time boiled, cooled, and filtered as before. By repeating this process four or five times, there will be left only a brownish-orange residue, on which the oil will refuse to act any longer. This residue being laid on a piece of earthenware, is to be exposed to a heat not higher than that of melting lead, till it ceases to exhale any fulphurous vapours; being then rubbed up with a little powdered charcoal and pressed into the bowl of a tobacco-pipe, or any other convenient vessel; it is to be heated nearly red, upon which a white vapour will arise, and shew itself to be arsenic, by its peculiar garlic odour. The fulphur precipitated from the oil of turpentine may be entirely freed from this latter by exposure to the air and light for a day or two; it will then be of a beautiful sparkling yellow colour (far superior to that of the common flowers of sulphur) and entirely inodorous. The common English brimstone or roll-sulphur sometimes contains a full fifteenth of insoluble residue, chiefly opiminent; the best Sicilian sulphur in small rolls, contains hardly more than three per cent. of residue which appears to be little else than earth, as it affords no arseneical odour when heated with charcoal. Aikin.

SULPHUR, in Chemistry, is a simple body, and susceptible of combustion. It is of a yellow colour, with a shade of green. It is very fragrant, and easily powdered. It has a peculiar taint, if we may so call that girtine has which distinguishes it from all other bodies, and also smell, especially when rubbed. At the common temperature it is inodorous, unless when rubbed; but if a roll of sulphur be held for a minute in a moist warm hand, it breaks across with a sharp cracking, not unlike the snapping from the discharge of an electric spark, the hand acquiring a peculiar disagreeable odour, which lasts some minutes. It is a nonconductor of electricity and becomes suddenly electrified by rubbing with the hand. Its specific gravity is 1.99, water being 1. Dr. Wollaston has ascertained, that it refracts light more than water, their powers being as .201 to 1.336. Its specific heat is said to be 1.83, water being 1. It fuses at about the temperature of 200° or 224° Fahr., when it melts into a transparent brownish-red fluid. By an increase of heat, the fluidity diminishes, and the sulphur begins to sublime in visible vapours. When it somewhat exceeds the temperature of 300° Fahr., its confidence will be like that of treacle, and the vapour will take fire, the inflammation spreading instantly to the whole mass. If kept some time in fusion, it becomes thick and viscous. When sulphur has become viscous by heat, its fluidity may be restored merely by lowering its temperature: and if, after having been kept in this state for a few minutes, it be poured, without previous cooling, into warm water, it does not become hard and brittle, as in its natural state, but remains soft, like wax, and of a reddish or brown colour. In this state it is employed to receive impressions from seals and medallions, which afterwards hardening, become permanent, and are known in the arts by the name of sulphur casts. This substance has been fupposed to be an oxvd of sulphur by some, but it is doubted by others.

When sulphur is heated in a close vessel beyond its fusing point, it ultimately assumes the elastic form, and may be sublimed or distilled into a separate vessel. It adheres to the sides of the receiver in an efflorescent form, in which state it is known by the name of flowers of sulphur. At the temperature of 500°, when atmospheric air is present, it burns with a blue flame, giving out suffocating fumes, as experienced in lighting the common brimstone-match. This arises from its combination with oxygen, a compound to be yet treated of. The atom of sulphur is 15, oxygen being 7.5: and hydrogen 1.

Sulphur combines with the metals, and all the other inflammable bodies perhaps, with the exception of azote. Its combination with the metals, and the earths and alkalies, are treated of under those bodies respectively, and are termed fulphurets, which see.

Sulphur combines with oxyquiriatric acid, forming a peculiar compound. This substance was discovered by Dr. Thomson, who considered it, at the time, as a compound of muriatic acid and oxvd of sulphur, and called it fulphuritted muriatic acid. Under the consideration of the oxyquiriatric acid being a simple body, this compound has been called sulphuranse by sir Humphrey Davy, and chloride of sulphur by Dr. Thomson. It is formed by passing chlorine gas over flowers of sulphur, or by heating sulphur in a retort filled with the same gas. The result of this union is a liquid of a red colour, when viewed by reflected light; but by transmitted light, it is of a yellowish-green colour. It smokes when exposed to the air, and its fumes irritate the eyes. It has a strong smell, resembling that of sea-weed. Its specific gravity is 1.6. It does not appear, in a pure state, to possess acid properties. It does not red-den litmus, when perfectly dry. When water is added, the mixture becomes cloudy, sir Humphrey Davy fays, by the deposition of sulphur: he further observes, that the mixture
SULPHUR.

mixtume becomes strongly acid, and that it is found to contain oil of vitriol. According to the original experiments of Dr. Thomson upon this substance, the proportion of chlorine to the sulphur was about 35 to 51, which would give nearly twice as much of sulphur.

Sir Humphrey Davy's experiments shew their proportions to be from 10 grains of sulphur to 30 cubic inches of chlorine, which give their proportions 1 to 2.38, which is very nearly 1 atom of sulphur, 15 acid, and an atom of chlorine 33. If the last account be correct as to the proportions, when the compound is added to water, two atoms of muriatic acid and an atom of sulphuric acid ought to be produced. But sir Humphrey rates, that free sulphur was seen, and that oil of vitriol was found in the mixture. It appears unlikely, that in a situation where sufficient oxygen was present to convert all the sulphur into sulphurous acid, there would be free sulphur and sulphuric acid.

Some accurate experiments on the combination of chlorine with sulphur and phosphorus would be highly useful in the present state of chemical science.

Sulphur combines with phosphorus (see Phosphorus), and also with carbon (see Carbon), forming a liquid compound, which has been thought to be a compound of hydrogen and sulphur, and has been long known by the name of alcohol of sulphur.

This substance is considered by Sir Humphrey Davy as a compound of sulphur and hydrogen, with more sulphur than the last sulphuret. This opinion cannot be founded upon the process he gives for its preparation. He says it may be formed by palling sulphur over charcoal ignited in a porcelain tube: the experiment must be made with the exclusion of air. This point has been settled by Berzelius and Dr. Marcet, in a paper by these gentlemen, read to the Royal Society on the 29th of April, 1813, where it is clearly made out to be a compound of sulphur and carbon.

They obtained it by subliming sulphur through ignited charcoal in a porcelain tube. The first product is a liquid of a yellowish colour, which colour is owing to the presence of a little sulphur. By distillation in a glass retort a colourless product is obtained, which is the pure sulphuret of carbon.

Its taste is exceedingly pungent and disagreeable, and its smell stronger than sulphuret of hydrogen. It boils at the temperature of 110° or 115°. The elasticity of its vapour at 53°, is such as to support 7.25 inches of mercury. Water at the same temperature supports 433, alcohol 1.2, and ether 11 inches. It produces by its evaporation greater cold than ether, and advantage has been already taken of this to freeze mercury. It may be cooled down to 50°, without congealing. It readily dissolves sulphur; but if to the solution be added ether or alcohol, the excess of sulphur is precipitated, and the two liquids combine.

Mercury and potassium undergo no change when heated in this liquid: but when potassium is heated in a vessel exhausted of air, and filled with the vapour of sulphuret of carbon, it burns with a red flame. The combustion is the result of the sulphur combining with the potassium. A black matter is produced; and if water be added, a common sulphuret of potassium is formed, mixed with the carbon which was separated. The authors of these experiments, in order to ascertain whether the sulphuret of carbon contained hydrogen, mixed some of its vapour with oxygen gas, and exploded it by the electric spark, but no water was obtained, which would have been the case, if hydrogen had been present. They did not obtain the slightest trace of muriatic acid, by treating this gas with chlorine. These, and several other sensible tests, were used without hydrogen being detected.

In other experiments they found, that when it was burnt with oxygen, sulphurous and carbonic acids were obtained, and in the residue carbonic oxide; but they found nothing to indicate the presence of any other element in this compound, than sulphur and carbon.

The last enquiry was to ascertain the proportions in which these elementary bodies existed in this compound. By passing its vapour slowly through a red-hot tube filled with red oxide of iron, the oxygen combined with carbon, forming carbonic acid, and perhaps carbonic oxide. The sulphur combined with the iron. In order to ascertain the proportion of sulphur, the iron containing it was dissolved in nitric acid. This converted the sulphur into sulphuric acid, which was then precipitated by barytes, and from that it fell the weight of the sulphur could be estimated. The result of this analysis gave

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<tr>
<th>Substance</th>
<th>Percentage</th>
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<tr>
<td>Sulphur</td>
<td>84.83</td>
</tr>
<tr>
<td>Carbon</td>
<td>15.17</td>
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This is equivalent to two atoms of sulphur and one of carbon, which would be in the ratio of 30 to 5.4, and this would be

<table>
<thead>
<tr>
<th>Substance</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Sulphur</td>
<td>84.5</td>
</tr>
<tr>
<td>Carbon</td>
<td>15.5</td>
</tr>
</tbody>
</table>

100.

Berzelius has found that this substance combines with ammonia and lime, forming peculiar compounds. It will probably be found to combine with some of the other oxides.

The combinations of sulphur with oxygen are supposed to be three, but two only are at present known. These are sulphurous and sulphuric acids.

Sulphur, in fine powder, is sparingly soluble by digestion in highly rectified alcohol, but a more concentrated solution is made by precipitating each to the other in the state of gas; for this purpose, put some sulphur into a crucible, and suspend within the flame a vial filled with alcohol, then lute on a head and proper apparatus, and proceed to distillation; both the sulphur and alcohol are volatilized, and meeting with each other in the upper part of the vial, combine readily together, and condense in the receiver into a yellowish strongly smelling fluid, from which nearly the whole of the sulphur may be again precipitated by the addition of water.

Oil of turpentine and the other effluvial oils dissolve a considerable proportion of sulphur when hot, the greatest part of which they again deposit in crystals if cooled slowly. The fat oils unite with sulphur by boiling, and acquire a deep yellowish-brown colour, and a strong fetid odour; the combination is generally called balasam of sulphur. By long reposing in a cool place, it deposits small octahedral crystals of sulphur.

The order of affinities for this substance, according to Bergman, is fixed alkali, iron, copper, tin, lead, silver, bismuth, antimony, mercury, arsenic, and molybdena.

The uses of sulphur are very important. It is employed in medicine; it enters into the composition of sulphuric acid, of gunpowder, and of the common composition for paying the bottoms of ships. Its fumes, when burning, are employed for bleaching of silk and wool, and checking the progress of vinous fermentation. Common matches, which
SULPHUR are in daily use for lighting of fires, derive their principal utility from being tipped with sulphur. SULPHUR is of Antimony, Golden. See Antimony.

SULPHUR, in the Medecin de Plante, is laxative, and a stimulating diaphoretic. Its operation is gentle, and on this account it is one of the best means for keeping the bowels loose in hemorrhoidal affections; and the diaphoresis, which it excites, renders it serviceable in chronic rheumatism and catarrh, and in aconit, root, rickets, asthma, and other phlegmonic affections unattended with acute inflammation. It is supposed to combine with hydrogen in the stomach. It manifestly transpires through the skin, perhaps in the state of sulferated hydrogen; and this may be the cause of silver's being blackened in the pockets of those who take sulphur. It is specific in phlegm and some other catarrhal affections, in which it is applied externally, and taken internally at the same time. The dose may be from 3 j to 3 j, mixed into a solution with syrup or tussar, or in milk. Its purgative power may be increased by combining it with super-tartrate of potash; and in haemorrhoidal cases with magnesia. Its official preparations are as follows:

Sulphur lotum, or washed sulphur. That of the Russian. Ph. is obtained by pouring upon a pound of sublimed sulphur boiling water, the liquid being drawn off from time to time, washed away, and then drying it. The sulphur sublimatum lotum, or washed sublimed sulphur of the Edinb. Ph., is prepared by boiling a pound of sublimed sulphur for a short time in four pounds of water, then pouring off this water, by repeated affusions of cold water, washing away all the acid, and, lastly, drying the sulphur. The Dubl. Ph. directs warm water to be poured upon sublimed sulphur, and the washing to be repeated as long as the water employed shall appear acid, which is known by means of a test paper; and then dry the sulphur on cellophane paper. Sulphur precipitatum, or precipitated sulphur of the Lond. Ph., is prepared by boiling a pound of sublimed sulphur, and three pounds of fresh burnt lime, together in water; then filtering the liquor through paper, and dropping into it as much astringic as may be sufficient to precipitate the sulphur; and finally washing this with repeated affusions of water, until it becomes tafetaf. The precipitated sulphur is white, with a very light greenish tinge; its whiteness being owing to the presence of a little water. It differs in no respect from sublimed sulphur.

Oleum sulphuratum, or sulphurated oil of the Lond. Ph., is obtained by adding four ounces of washed sulphur gradually to a pint of olive-oil, heated in a very large iron-pot, and stirring the mixture after each addition till they have united. Or, according to the Edinb. Ph., by boiling eight ounces of olive-oil and one ounce of sublimed sulphur with a gentle heat in a large iron vessel, stirring constantly until they unite. N.B. Care should be taken to prevent the mixture from boiling over, and the iron-pot should be sufficient to contain the bulk of the ingredients. The odour of this solution is fetid, and the tafeta acid; its colour is a brownish-red; its consistence thick; and when heated, it emits sulphurated hydrogen; when much concentrated, the sulphur crystallizes in octoehedrons. This oil is stimulant, and externally detergent. It was formerly regarded as a balsamic, and recommended in catarrh, asthma, and phlegmatic affections; but its internal use is now properly exploded. When employed, its dose was from 1/2 to 1/4 of an ounce. It is sometimes externally applied for cleansing foul ulcers. The official preparations are:

* Emplastrum ammoniacum cum hydrosypry, and emplastrum hydrosypry. (See Emplastrum.) Unguentum sulphuris, and unguentum sulphuris compositum. (See Unguet.)

SULPHUR CRUDE, in Geography, a branch of Green river, in Kentucky.

SULPHUR ISLAND, an island in the North Pacific ocean, discovered by Captain Gore in the year 1790, about five miles long, in a N.N.E. and S.S.W. direction. The S. point is a high barren hill, flat-topped at top, and when seen from the W.S.W., it presents an evident volcanic crater. Its surface exhibited a variety of colours, and a considerable part of it was conjectured to be sulphur, both from its appearance and smell. N. lat. 24° 49'. E. long. 149° 12'.

SULPHUR MOUNT, a mountain of Guadaloupe, famous for the exhalation of sulphur and athes.

SULPHURATED IRON. See Iron.

SULPHURATED SILVER. See Silver.

SULPHURATED WINE. See Wine.

SULPHURES, or SULPHURETS, are combinations of alkalies, earths, or metals, with sulphur; and hence a suffusion is said to be "sulphurated," when it is combined with sulphur.

The several combinations, to which we now refer, are:

sulphurated hydrogen, and the hydro-sulphurates (see each article); the sulphurets as above defined (see Sulphur, and the articles infra); the super-sulphurated hydrogen, or sulphurated hydrogen, with a considerable, but in general an uniform, excess of sulphur; and the sulphurated hydrogen, or combinations of sulphur, sulphurated hydrogen, and the alkaline or earthy bases.

SULPHURET OF HYDROGEN is a gaseous compound of sulphur and hydrogen. It constitutes a portion of the atmosphere, but is most abundant where animal matter is undergoing decomposition. Its presence is easily detected by a plate of polished silver, which it first turns yellow, and ultimately a bluish-black. This gas was formerly denominated "heptic acid;" by Berthelot and other French chemists it is called "gas hidrogene sulfuric;" and by some German authors "hydrothionic acid;"

The best way of procuring sulphuret of hydrogen is from a sulphuret of iron, which is prepared as follows:

Heat a bar of iron to a bright red heat; then apply to it a roll of brimstone; the sulphuret will be formed, and drop off in the liquid form. These limbs must be collected and kept in a close-flapped bottle.

To one part of this sulphuret in a glass bottle, add two parts of water and one part of sulphuric acid. The addition of the acid causes the immediate evaporation of the gas, which, for nice purposes, should be collected over mercury, since water absorbs a considerable portion of it.

This gas, like hydrogen, takes fire, and burns with a pale blue flame. It is rather heavier than common air, in the proportion, according to Kirwan, of 10000 to 9053; so that 100 cubic inches of it weigh about 33 grains. When moderately diluted, it may be breathed for a short time without danger.

It has a fetid and disagreeable smell, which owing to its presence, we perceive in rotten eggs; and when water is added to the residuum of inflamed gunpowder, it changes vegetable blues red, and has some other properties common to acids.

Water absorbs its own volume of this gas, to which it gives a disagreeable smell and taste, as is evinced in the water at Harrowgate, and many other natural springs. It blackens some of the white metals, and all their solutions, particularly lead, silver, and mercury, and precipitates several metals from their solutions; and it combines copiously with the alkaline, earthy, and metallic bases, saturating them like an acid.
SULPHURET.

It is constituted by one atom of sulphur 15, and one of hydrogen 2; the hydrogen gas not changing its volume. Hence its atom and specific gravity are each equal to 16, hydrogen being 1. This result is confirmed in the decomposition of this gas by electricity. The sulphur is deposited till the hydrogen remains pure, without any change of volume. See Sulphuretted Hydrogen and Gas.

This gas combines with an equal volume of ammonia, forming a substance having all the characters of a salt. It also combines with the alkalies, earths, and other oxides, forming salts. This is a sufficient proof of its acid characters.

Gay Lussac has on this account called it the hydrofulphuric acid, and its compounds with oxide, hydrofulphates. These have been formerly called hydrofulphurates. If the idea becomes finally adopted, that acids may exist without oxygen, Gay Lussac's nomenclature is the most correct. This ingenious chemist supposes that sulphur, carbon, and azote, may act the part of oxygen; and that chlorine and iodine are of the same class; and that all of them, except oxygen, have a double property of acting as the base and the acidifying principle. In sulphuric acid, for instance, the oxygen is the acidifying principle; but in the gaseous body of which we are treating, the hydrogen may be considered the base of the acid, and the sulphur the acidifying principle. The same thing may be observed of chlorine and iodine. See Simple Bodies.

Sulphuretted hydrogen exercises a very strong action on some metals in subsistence, and on many more metallic faults. The metals that are not precipitated from their solutions by it, are iron, cobalt, nickel, manganese, and in some cases antimony and arsenic. These solutions, however, are deeply coloured by the sulphuret; that of iron becoming black; of antimony, orange; of arsenic, yellow, &c.; but either no precipitate forms, or if formed, it is redissolved by an excess of acid. Thus, if sulphuretted hydrogen is added to a solution of the red sulphate of iron, the metal is immediately brought to the state of the green, or lefs oxygenated sulphate, but no precipitate is formed, unless the sulphuretted hydrogen be in great excess, as the red sulphate has naturally an excess of acid. On this principle is founded an useful test to distinguish iron from lead in wine or any other liquor; for by adding hydro-sulphuretted water, and a slight excess of dilute muriatic, or any other weak acid, if iron only be present, the liquor will assume a deep red, but will remain transparent, whereas lead will give a black muddy sediment. Often, too, this test is useful for separating one metal from another in the same solution, both where a precipitable and a non-precipitable metal are present, and where there are metals more or less easily precipitable. Thus, if manganese, zinc, tin, and copper, are in the same solution, the first addition of hydro-sulphuretted water will separate the tin, after which the copper will fall, and then the zinc, while the manganese remains in solution.

In all the above circumstances, it is the simple his hydro-sulphuretted water which is meant, and not the alkaline hydro-sulphurets; for though the action of the latter is in general very similar to that of the simple hydro-sulphurets, there are some important differences; and in particular, the alkaline hydro-sulphurets precipitate all the metallic solutions without exception.

For an account of the alkaline and earthy hydro-sulphurets, we refer to the article Sulphuretted Hydrogen; supplying here the deficiencies of that article. For the hydro-sulphuret of barytes, see Barytes. The hydro-sulphuret of strontian is formed like that of barytes; and the gas which it gives out, when decomposed by acids, burns with a red flame, like the other faults of frontian. (See Strontian.) An hydro-sulphuret of magnesia is formed by diffusing pure magnesia through water, and passing through it sulphuretted hydrogen, and thus effecting a solution. (See Magnesia.) For the hydro-sulphuret of lime, see Lime.

The hydro-sulphuret of ammonia of the Edinb. Ph. is prepared by expelling four ounces of water of ammonia in a chemical apparatus, to a current of gas arising from four ounces of sulphuret of iron, and eight ounces of muriatic acid, previously diluted with two pounds and a half of water. The sulphuret of iron for this purpose may be conveniently made from purified rust of iron, three parts, sublimed sulphur, one part, mixed together, and exposed in a covered crucible to a moderate fire, until they cobere in a mafs.

The hydro-sulphuret of ammonia of the Dub. Ph. is obtained by putting four ounces of sulphuret of iron in coarse powder into a matrix, and pouring gradually over it seven fluid-ounces of muriatic acid, diluted with two pints of water; and in a proper apparatus transmitting the gas evolved from it through four ounces of water of caustic ammonia. Toward the close of the operation apply a moderate heat to the matrix.

This hydro-sulphuret is of a dark-green colour, has a very fetid odour, and an acrid disagreeable taste. It is decomposed by the acids. This preparation is a powerful purge, relieving the action of the stomach, and of the arterial system, in a remarkable degree; and even in moderate doses producing sicknes, vomiting, and vertigo. It was first proposed as a remedy by Mr. Cruikshank, with the view of diminishing the morbid appetite and powerful action of the digestive organs, which attend those laboursing under diabetes mellitus; and its subsequent use has been confined to the treatment of that disease. The dose to an adult should not at first exceed m v, or m vj, given in a large tumbler of water, three or four times a day; and the number of drops should be gradually increased, until a flight degree of godliness takes place, when any further increase must be stopped.

SULPHURETS of Heparis, or Liver of Sulphur. See Liver of Sulphur.

When sulphur is melted with an alkali, a brown uniform mass is produced, which, as long as it continues dry, is a simple combination of sulphur and alkali. But while dissolving in water, a certain quantity of sulphuretted hydrogen is immediately generated, which remains in the solution and unites with the sulphur and alkali, but may be expelled by the addition of an acid, which at the same time precipitates the greater part of the sulphur in a state of purity. The liquid sulphurets therefore contain sulphur, alkali or alkaline earth, and sulphuretted hydrogen, so that they differ from the hydro-sulphurets of the same bales in containing a large excess of sulphur, and therefore give with acids a copious precipitate of sulphur, which the simple hydro-sulphurets do not.

SULPHURET of Lime. See Lime.

SULPHURET of Potasb, or the common Liver of Sulphur; which see. See also Salts.

The sulphuret of potas of the Lond. Ph. is prepared by rubbing together an ounce of washed sulphur and five ounces of subcarbonate of potas, and placing the mixture over the fire in a covered crucible until they unite.

The Edinb. Ph. directs to take carbonate of potas and sublimed sulphur, of each eight ounces; rub them together, and put them into a large crucible, to which a cover is adapted, and apply the fire cautiously till they melt.

The sulphuret of kali of the Dub. Ph. is prepared by mixing
mixing together subcarbonate of kali and sublimed sulphur, of each two ounces; and exposing them in a crucible, with an adapted cover, to a fire gradually raised till they unite. Well prepared sulphuret of potash is inodorous while dry; but when moistened or dissolved in water, it emits the fetid odour of sulphuretted hydrogen. Its taste is bitter and acrid; it changes the vegetable blues into green; it is hard and brittle; breaks with a glassy fracture; is of a liver-brown colour, and stains the skin brown. On being exposed to the air it attracts moisture; its colour changes to a pale green; the fetid odour is emitted, and it is gradually converted into hydrogurgetted sulphuret of potash, combined with a small portion of sulphate of potash. It is also decomposed by acids; and in a violent heat the sulphur sublimes, leaving behind the potash. It is expectorat and diaphoretic. It has been frequently given in chronic asthma and chronic catarrh, without much benefit; but has been found useful in arthritis, rheumatic, and herpetic affections; and in combination with cicutia, as a palliative in cancerous cases. From a theory founded on its chemical action on metallic salts out of the body, it has been strongly recommended as an antidote against arlenical, saturee, and mercurial preparations, when these have been taken in doses sufficient to produce deleterious effects; but it has hitherto been too seldom employed to ascertain its real value in these cases. The usual dose is grs. iij. or grs. iv., combined with soap, in the form of pills, for the first-mentioned cases; or from grs. v. to grs. xx., as an adjunct to cicutia in cancer, given several times a day.

Sulphurets of Barites and Strontian, Liquid, may be obtained either by boiling the pure earth with sulphur and water, or by calcining the sulphates of these earths with charcoal, to convert them into sulphurets, and dissolving the latter out from any remaining undecomposed sulphate.

Sulphuret of Ammonia, Boyle's fuming liquor, or volatile liver of sulphur, is a combination of sulphur with ammonia, which cannot take place except in the liquid form, and in this case with difficulty, and only through the medium of dilatation. The process for obtaining it, being an improvement of that of Beaumé, is as follows: Mix together in a mortar, and put into a retort, 3 lbs. of flaked lime, 1 lb. of sal ammoniac, 8 oz. of flowers of sulphur; and add to this, when in the retort, 6 oz. of water. Adapt a tubulated receiver, and proceed to dilatation with a gentle heat. The first drops that fall are nearly watery, but those that follow are yellow; and when about 6 oz. of liquor have distilled over, a vast quantity of white elastic vapour arises, which fills the receiver, and would burst it, if it had not vent, and of which only a portion is condensed, and with great difficulty. The fire is then to be kept up steadily for an hour or more, till the bottom of the retort becomes brightly red, during which about six or eight ounces more of liquid are obtained.

The product of this dilatation is a yellow, pungent liquid, smelling strongly both of ammonia and of sulphuretted hydrogen, and giving out abundance of white fumes the moment it is uncorked. It is the liquid sulphuret of ammonia. In this process the ammonia, expelled from the sal ammoniac by means of the lime, acts upon the sulphur in the moment of its formation, dissolves the sulphur, and, together with the water present, rises in vapour, and condenses in the receiver. Though only fix ounces of water are added to the mixture, full double the quantity is obtained, the whole being expelled from the flaked lime by the heat. If less water is added, the product is still more fuming, and there is a still greater waste of incenerable vapour. This waste, however, was only incurred before the invention of Woulfe's apparatus; for by its adoption the whole of the vapour may be condensed, either in water, or in an alkaline solution, at pleasure.

Berthollet instituted a course of experiments to ascertain the precise nature of this fuming liquor, for an account of which we refer to Aikin's Dictionary.

Sulphuret of Water. (See Antimony.) The prepared sulphuret of antimony of the Edinb. and Dub. Ph. is an inodorous, infipid, blackish or deep leaden-grey dull powder, which stains the fingers, and is insoluble in water. It is inert, except where it meets with acid in the stomach, in which case it usually operates either as a diaphoretic or mild cathartic; but occasionally produces expectoration and purging; so that the stomach and bowels should be evacuated previously to its use. It has been found efficacious in cirsitis, chronic rheumatism, and herpetic eruptions. The dose is from grs. v. to 3j.; mixed with honey or any convenient vehicle. The official preparations are, oxydum antimonii, oxydum antimonii cum sulphure vitriificatum, antimonii sulphuraturn precipitatum, and pulvis antimonialis. See Antimony.

The precipitated sulphuret of antimony of the London Ph. is prepared, by mixing 2 lbs. of sulphuret of antimony in powder, four pints of solution of potash, and three pints of distilled water; and boil the mixture over a gentle fire for three hours, stirring it constantly, and occasionally adding distilled water, so that the same measure may be kept up. Strain the solution through a double linen cloth, and while it is hot, drop in gradually as much sulphuric acid as may be necessary for precipitating the powder; then wash away the sulphate of potash with hot water, dry the precipitated sulphuret of antimony, and rub it into powder. The Edinb. Ph. directs to boil 4 lbs. of solution of potash, 3 lbs. of water, and 2 lbs. of prepared sulphuret of antimony, in a covered iron-pot, over a gentle fire for three hours, stirring often with an iron spatula, and adding water as may be necessary. Strain the hot liquor through a double linen cloth, and add to it as much diluted sulphuric acid as may be required for precipitating the sulphuret, which must be well washed with warm water. The "brown antimonized sulphur" of the Dub. Ph. is obtained by mixing subcarbonate of kali, and prepared sulphuret of antimony, of each 1 oz.; melting the mixture in a crucible, and when cold, reducing it into a powder. Put it into a mortar with four pints of water, and boil for a quarter of an hour; then remove the vessel from the fire, and cover it when the liquor becomes liverpied after setting, decant it cautiously from the sediment. The antimonized sulphur will partly separate as the liquor cools; add as much diluted sulpiuric acid as will precipitate the whole of it, which takes place with an excess of acid; then agitate the mixture, that the latter precipitate (of an orange colour) may be mixed with the rest; and when it has subsided, pour off the liquor from the sediment, which is to be washed with cold water as long as it emits indius indicates the presence of acid in the effused fluid: finally, dry it upon tibulous paper. The refult of these different formulæ is the same, viz., a sulphuretated hydro-sulphuret of oxyd of antimony. In the Dublin procés, the precipitate thrown down whilst the decanted liquor cools is a powder of a brick-red colour, the well-known kermis mental, which is the oxyd of antimony in union with such portions of sulphur and sulphuretted hydrogen only as it can attract; while the precipitate, afterwards thrown down by the acid, is the old sulphuret of antimony, or a hydro-sulphuret of antimony with an excess of sulphur, but not enough to form a compound, or intermediate product, is obtained, which is the sulphuretated hydro-sulphuret of the oxyd, as in the former
SULPHURIC ACID.

former cases. According to Theard, the oxide in these two powders is in a different state of oxidization; an opinion, however, which is at least very problematical. The following are the proportions of their constituents given by him: Kerneous mineral consists of 72-760 parts of brown oxide of antimony, 20-308 of sulphurated hydrogen, 4-156 of sulphur, and 2-786 of water and loof; golden sulphur of antimony contains 68-30 of orange oxide of antimony, 87-90 of sulphurated hydrogen, 2-130 of sulphur, and 1-823 of water and loof—in 100 parts. But the real difference appears to consist in the larger portion of sulphur thrown down with the golden sulphur; the base being the same in both as stated by Tammendorff.

The precipitated sulphuret of antimony, as it is called, is an orange-coloured powder, slightly fussy to the taste, inodorous, and insoluble in water. It readily catches fire, and burns with a blue and greenish flame, excites the odour of sulphurous acid, and leaves the metal, after the combustion, in the form of a greyish-white oxide.

This preparation of antimony is diaphoretic and expectorant. It was formerly much employed in asthma, and in catarrhal affections; but it is uncertain in its operation, often producing vomiting in very small doses, and is not much employed in modern practice. It is, however, when combined with mercurials, a useful alterative in herpetic eruptions.

SULPHURET of Iron. (See Iron.) The sulphuret of iron of the Dub. Ph. is obtained by mixing six ounces of filings of iron, and two ounces of sublimed sulphur, and exposing them in a covered crucible to a gentle heat till they unite.

SULPHURET of Mercury, Black, or Ethiopic mineral. See MERCURY.

SULPHURET of Mercury, Red. See MERCURY.

SULPHURETTED Sulphur, Super, Hydrogenated Sulphur of Chenevix, Soufre Hydrogiante, is a very curious combination discovered by Berthollet, and consisting simply of sulphuretted hydrogen, with a large excess of sulphur, and without any alkaline or other base. It is prepared by mixing at once a large proportion of muriatic acid with liquid sulphuret of potash, or better, by pouring the sulphuret in small portions into the acid, during which most of the sulphur is precipitated as fusible, but very little effervescence takes place, and the sulphuretted hydrogen, instead of escaping in a gaseous form, does with a portion of the liquid hydrogen, and so the compound is thrown down into a liquid of the appearance of oil, which gradually collects at the bottom of the vessel in which the mixture is made. This substance was first noticed by Scheele.

When this sulphur is kept in a phial with water, on the surface of which it swells, it is constantly in a state of ebullition, and if the phial is uncorked, the whole of the sulphuretted hydrogen escapes, and the sulphur returns to its original state, and falls to the bottom of the water. Also, if a little of this liquid is taken in the mouth, it gives a pungent, bitter, hydro-sulphuretted taste, which soon goes off, leaving nothing in the mouth but solid sulphur, sticking to the teeth.

When a solution of potash is added to super-sulphuretted hydrogen, a small portion of sulphuretted hydrogen escapes, and the remaining unites with the potash, forming a solution, which resembles in every respect the common liquid sulphuret of potash.

SULPHURIC ACID, Vitriolic Acid, or Oil of Vitriol, is formed by oxygen and sulphur; but it is also found that water is essential to the existence of this acid.

In the most concentrated state in which sulphuric acid can exist, it is a transparent, colourless, dense liquid, of an oily consistence, and greatly to the touch. Its taste is very caustic, and so extremely sour, that a few drops only will render a pint of water too sour to drink. It has no smell, except when it is contaminated with animal or vegetable matter, the smallest quantity of which discolours it. When exposed to these influences it destroys their texture, and leaves a black mark. It changes most vegetable blues to red, and manifests other qualities of acids in a very eminent degree.

The fixity of sulphuric acid is very considerable; when in the state of common oil of vitriol, it requires nearly a red heat for its vaporization; and though when diluted with water it will boil at a considerable lower temperature, yet little else than water is driven off, and the acid becoming more and more concentrated, requires a continually increasing heat to keep up its ebullition, till it arrives at the degree necessary for the volatilization of the acid itself.

Sulphuric acid freezes or cryallizes by exposure to cold, and it appears to coagulate with more ease when moderately concentrated than when it is dilute; this remarkable circumstance was first pointed out by the duc d'Ayen, who was then confirmed by Moreau, and has since been treated at large, and in a very satisfactory manner, by Mr. Keir. (Phil. Trans. for 1787, p. 267.) This accurate observer found sulphuric acid of the specific gravity of 1.738, contained at about 40° Fehr; but that if the density is either increased or diminished, a greater cold is required for its congellation. Proceeding from the above density in each direction, he found that sulphuric acid at the specific gravities of 1.730 and 1.775, or at any intermediate density, freezes when exposed to the cold of melting snow; that if the energy of the freezing mixture be increased by the addition of common salt, it will cause sulphuric acid at the specific gravities of 1.841 and 1.75; or at any intermediate density; but that acids at the specific gravities of 1.815 on the one hand, and 1.745 on the other, continue fluid. Sulphuric acid while freezing contains considerably in its dimensions; sometimes it forms a congealed mass, but often shrinks into large regular crystals in the form of oblique truncated octahedrons, or compressed hexagonal prisms, terminated by hexagonal pyramids.

Sulphuric acid attracts water with great avidity, and accumulates in bulk. This takes place even in a flopped bottle, if the flopper does not fit very tight. If some of the sulphuric acid at the usual density of 1.85 be mixed with one-fourth of its weight of water, the temperature of the mass instantly rises to near 500° Fehr, and a mutual penetration takes place, the density of the compound being greater than the mean density of its ingredients. If even four parts of sulphuric acid and one of ice, both at the temperature of 30°, be mixed together, the heat of the mass will rise to 212°; but if the proportion of ice be increased considerably, the caloric necessary to the liquid state of the mixture will exceed that which is extracted during the combination of the ingredients, and cold will be produced; thus, if four parts of ice and one of acid at 30° be mixed together, the temperature of the mass will be cooled down to − 4°. But in all cases where concentrated sulphuric acid is employed in the composition of freezing mixtures, there is at the moment of their combination, as Beaumé has well observed, a very sensible production of heat, which must materially diminish the friability of the ice; thus, according to the able chemist last mentioned, (Chem. Exper. i. p. 219.) if one part of sulphuric acid at the temperature, and four parts of ice, be mixed together, the effect is to raise the thermometer in an
SULPHURIC ACID.

an instant to 94° Fhr., from which it sinks as speedily to 34°. But if the acid has been previously diluted with water, the temperature sinks on the addition of ice to 5° Fhr., without any previous heat having been excited. So powerful is the affinity of sulphuric acid for water, that it will absorb moisture with great rapidity from the air, so as in a very few days to double or treble its weight. Even a boiling temperature, when the acid is moderately concentrated, will not counterbalance this strong tendency; hence it is that sulphuric acid cannot by boiling in an open vessel, be concentrated nearly so much as by distillation in a close apparatus.

The specific gravity of this acid varies from 1.85 to the most dilute acid, depending upon the water it contains.

The following table of the specific gravities of sulphuric acid of different strengths, is taken from Mr. Dalton’s New System of Chemical Philosophy.

**Table of the Quantities of real Acid, in 100 Parts of Sulphuric Acid at 60°.**

<table>
<thead>
<tr>
<th>Atoms of Acid</th>
<th>Acid per cwt. by Weight.</th>
<th>Specific Gravity.</th>
<th>Boiling Point.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 + 0</td>
<td>100 Unknown.</td>
<td>1.866</td>
<td>620°</td>
</tr>
<tr>
<td>1 + 1</td>
<td>81Unknown.</td>
<td>1.849</td>
<td>605</td>
</tr>
<tr>
<td>1 + 2</td>
<td>68Unknown.</td>
<td>1.823</td>
<td>581</td>
</tr>
<tr>
<td>1 + 3</td>
<td>58.6</td>
<td>1.791</td>
<td>560</td>
</tr>
<tr>
<td>1 + 10</td>
<td>30</td>
<td>1.750</td>
<td>550</td>
</tr>
<tr>
<td>1 + 17</td>
<td>20</td>
<td>1.720</td>
<td>540</td>
</tr>
<tr>
<td>1 + 38</td>
<td>10</td>
<td>1.690</td>
<td>530</td>
</tr>
</tbody>
</table>

The acid at 100°, at the head of the column, is the real acid, or that which combines with different bases, to form the salts called sulphates. It is difficult to say whether it does really exist in a separate state. Mr. Dalton says it is formed when nitrous gas, oxygen, and sulphurous acid, are mixed together, and appears in shining crystals, like hoar frost. On the other hand, sir Humphrey Davy affirms, that when nitrous acids, and sulphurous acid, are mixed, in a glass globe, and the gases perfectly free from moisture, no sulphuric acid is formed. But if a drop of water be introduced, there will be an immediate condensation, and a beautiful white crystalline solid will line the interior of the vessel; whereas, if the globe contain plenty of water, nitrous gas will be given off with great violence, and the water will be found to be a solution of oil of vitriol. We should feel some delicacy in doubting the accuracy of either of these authorities, but it is nevertheless certain, that one of them has been deceived. The experiments were certainly a little different. Mr. Dalton employed nitrous gas and oxygen, which we should imagine could not give a result different from sir Humphrey’s, who employed the nitrous acid ready formed. Both these chemists seem to agree, that the acid of the specific gravity 1.85 contains an atom of water. This acid is the strongest that can be made by concentration, for at its boiling point, which is 620°, the acid and water rife together.

It will be perceived from the table, that the specific gravity varies very little with the first portions of water; and hence it is a very uncertain test of the value of very strong acids. We have generally observed, that those who keep an hydrometer for the purpose of asfaying the oil of vitriol, hardly ever complain of its want of specific weight.

Mr. Dalton recommends the boiling point of strong acids as a better test of their strength. The table shews, that when the quantity of real acid varies one per cent, the specific gravity is only changed in the third decimal place; but the boiling point varies as much as 15°. This points out a simple method of asfaying sulphuric acid with much greater precision than by the hydrometer. An instrument might easily be constructed for this purpose. It should consist of a small platina cup, capable of holding as much sulphuric acid as will cover the bulb of a mercurial thermometer. An upper part may be attached to this cup, to contain the item of the thermometer, and at the same time to guard it from the heat of the fire on which the cup is placed.

The cup of platina, being filled with the acid to be tried, may be placed on a small charcoal fire, or a sand-bath, or indeed a clear common fire, till the acid boils, when it will shew the strength of the acid, by degrees marked upon the scale of platina: the degrees being expreessions of the specific gravity, instead of degrees of temperature. The firft column in the table gives the relative number of atoms of water and acid for different strengths. The way in which the acid mixes with water as well as with the solutons of salts, seems to favour the idea of their proportions being indefinite. But this is merely an apparent anomaly. The acid may combine with one, with two, with three, and perhaps a greater number of atoms of water, but this number may still be limited. An acid weaker than the limited number of atoms of water would give, is constituted by the limited compound becoming equally disperfed through a mass of water, the excess of water not being combined but merely mixed. Such may also be the case with solutons of salts.

That the acid and the water are combined chemically, the condensation of volume, and change of temperature, clearly prove; and in the present state of chemistry, it is not less clear that the proportions of compounds are limited.

Sulphuric acid is constituted by one atom of sulphur 15, and three atoms of oxygen 22.5, making its atom 37.5. The strongest liquid acid, as will be seen by the table, will consist of an atom each of acid and water, which will be 37.5 + 8.5 = 46: the specific gravity of this is 1.85. Acids of this strength, down to 1.8, have the name of oil of vitriol, from the circumstance of this acid being formerly distilled from green vitriol. That the component parts of sulphuric acid are sulphur and oxygen, may be demonstrated either by analysis or synthesis; thus, if sulphur be digested.
SULPHURIC ACID.

Digested with nitric acid, nitrous gas will be given out from the decomposition of the acid, while the oxygen, the other element, will combine with the sulphur, and form with it sulphuric acid; on the other hand, if sulphate of soda be mixed with charcoal and exposed to a red heat, the sulphuric acid is deoxygenated by the superior affinity of the charcoal; carbonic acid and carbonous oxide are produced, and the sulphate of soda is found to be converted into sulphuret of soda, from which the sulphur may readily be procured by solution in water, and the addition of an acid.

But though the elements of sulphuric acid are ascertained, much doubt still exists with regard to their relative proportion.

Several methods have been employed for ascertaining these proportions. Lavoisier, for this purpose, placed a given weight of purified sulphur in a receiver, with a little water to absorb the acid produced; then setting fire to the sulphur, he supplied it with oxygen gas of known purity, till the combustion ceased: then by ascertaining the weight of sulphur burnt, and of oxygen gas consumed, he inferred that sulphuric acid was composed of 57 parts of sulphur and 20 parts of oxygen. Berthollet, having ascertained that nitre and sulphur, in the proportion of four parts of the former to one of the latter, when heated in a retort, reacted on each other quietly and without explosion, mixed together 288 grains of nitre, and 73 grains of sulphur, and heated the mixture in a glass retort till the emission of nitrous gas entirely ceased. During the process, 12 grains of sulphur had sublimed unaltered, and 228 grains of sulphate of potash were produced by the combination of the alkaline base of the decomposed nitre with the newly produced sulphuric acid. Now, according to Kirwan, sulphate of potash is composed of 45.2 sulphuric acid, and 54.8 potash; therefore, out of the 228 grains of sulphate of potash, 103 grains were sulphuric acid, composed of 72 - 12 = 60 grains of sulphur, and 43 grains of oxygen; hence 100 parts of sulphuric acid consist of

<table>
<thead>
<tr>
<th></th>
<th>Klaproth</th>
<th>Thenard</th>
<th>Chenavix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>43.2</td>
<td>57.4</td>
<td>61.5</td>
</tr>
<tr>
<td>Oxygen</td>
<td>56.8</td>
<td>42.6</td>
<td>38.5</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

By another Statement.

<table>
<thead>
<tr>
<th></th>
<th>Klaproth</th>
<th>Thenard</th>
<th>Chenavix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>41.8</td>
<td>55.36</td>
<td>59.1</td>
</tr>
<tr>
<td>Oxygen</td>
<td>58.2</td>
<td>44.44</td>
<td>40.9</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Muriatic acid gas combines readily, and in abundance, with sulphuric acid; and the compound acquires a brownish tinge, and, when exposed to the air, emits dense white fumes of muriatic acid gas, probably mixed with a little sulphuric acid, as their odour is more pungent and suffocating than that of simple muriatic acid. The nitric and sulphuric acids unite readily together, either by direct mixture, or by adding a little nitre to sulphuric acid. This compound is of considerable use for recovering the silver from clippings and other refuse of the manufactories of silver-plate. Sulphuric acid absorbs, by agitation, a considerable quantity of red nitrous vapour, and in consequence acquires a light blue colour. The mixture, when exposed to the air, gives off a white vapour. If water is added, the great heat that is thereby generated causes a very rapid and copious emission of the nitrous vapour, and sulphuric acid and water alone remain behind. Sulphuric acid, thus impregnated with nitrous vapour, after a time becomes nearly colourless, and then concretes into solid crystals.

In this state, when dropped into water, it acquires a green colour, and both the crystals and water sparkle with the spontaneous and copious production of nitrous gas. When the crystals are simply exposed to heat, they melt, emit a dense red fume, and, after the nitrous vapour is thus driven off, the residue is common sulphuric acid.

Concentrated sulphuric acid, even when cold, acts in a very striking manner on most kinds of vegetable and animal matter. If a piece of paper or straw, for example, be immersed in sulphuric acid, the texture of the straw is speedily broken down, it acquires a deep black colour, and is diffused through the acid in a state of half solution. This phenomenon, however, does not take place, as is generally supposed, on account of the reaction of the sulphuric acid on the carbon and hydrogen, producing sulphurous acid, but from the strong affinity of the acid for water; in consequence of which, the oxygen and hydrogen of the vegetable matter combine together into water, while the carbon is precipitated.

Sulphuric acid combines with all the metallic oxides, with the alkalies, and all the earths except flaxes, forming an important genus of salts, called in the reformed nomenclature sulphates; which see.

The following is the order of the affinities of sulphuric acid: barytes, bontian, potash, soda, lime, magnesia, ammonia, glycine, yttria, alumine, zircon, metallic oxide.

When sulphur is burnt in oxygen, whether in the pure gas or in the atmosphere, it forms only sulphurous and not sulphuric acid; but if the sulphurous acid be absorbed by water, and exposed to the air for some time, the latter absorbs oxygen, and is converted into sulphuric acid. Hence sulphuric acid cannot be formed by the mere combustion of sulphur; a circumstance which renders the process of manufacture much less simple than it otherwise might be.

\[ \text{Sulphuric} \]
SULPHURIC ACID.

Sulphuric acid is at present formed by mixing together one part of nitre and seven parts of sulphur. This mixture is placed in a chamber, lined with lead. When these materials are set on fire, the nitre facilitates the burning of the sulphur; but it does not furnish sufficient to convert the sulphur into sulphuric acid. The 7 parts of sulphur will require 10.5 of oxygen for that purpose, but the nitre employed with it can furnish no more than .225, supposing the nitric acid to be reduced to the state of nitrous gas. This is so small a portion of the whole, that some other source must be explored, which is doubtless the atmosphere.

The combustion of the sulphur, which is facilitated by the presence of the nitre, first converts the sulphur into fulphurous acid; which, from its gaseous form, would soon be dispersed, if it were not condensed by its conversion into sulphuric acid. When a portion of the nitric acid of the nitre is decomposed by the sulphur, nitrous gas is evolved; but in its ascent, it meets with the oxygen in the chamber, and is converted into nitrous acid gas, which appears in red flames. The new-formed substance can now disperse of an atom of oxygen, which the sulphurous acid is wanting to convert it into sulphuric acid. The bottom of the leaden chamber is covered with water to the depth of two or three inches. This water seems to answer a double purpose; in first facilitating the action of the nitrous acid gas upon the sulphurous acid, and then dissolving the sulphuric acid as it is formed. When the nitrous acid gas has dispersed of its atom of oxygen, it returns to the state of nitric gas; and in rioting, unites with more oxygen, which it again gives to sulphuric acid; thus continuing its receiving and giving office, till it is accidentally dispersed through the same aperture which admitted the common air. A necessary connection between the chamber and the atmosphere will appear obvious. Atmospheric air must be admitted for the combustion of the sulphur, and to afford oxygen to the sulphurous acid; and through the flame, or some other opening, the residual azote must be returned into the open air. Some nitrous gas, and probably nitrous acid gas, will escape at the same time. If the latter were not the case, a constant decomposition of nitre by the sulphur would not be necessary. The theory of this process has been given by the French chemists, Chemist and Deformeur. Sir Humphry Davy objects to it in some degree. He holds, that the union of the oxygen of the nitrous acid with the sulphurous acid does not take place till they come in contact with water; the latter, according to his opinion, being essential to the constitution of the sulphuric acid. If the above theory be correct, a simpler mode of manufacture might be pointed out. The combustion of the sulphur might be so managed, as to furnish the sulphurous acid without loss, but mixed with azote.

From another source nitrous gas and atmospheric air may be furnished. These with the other products meeting where water is present, ought to form sulphuric acid in a very small space compared with the large chamber at present employed. The gases, by this means, might be furnished in proportions so exact, that nothing but azote would escape.

The acid and water which cover the floor of the chamber now only arrive at a certain strength, which is very far short of that required. At that strength it is drawn off, and not taken by evaporation. This used to be performed in glass retorts, which are very liable to break. If this is not performed in a retort from which there is but a small opening, the acid would not part with so much of its water, and its concentration would be limited at a very inferior strength to that used for most purposes. Dr. Wallotta has introduced vessels for the concentration of oil of vitriol made of platina: they are very expensive, but answer the purpose admirably. Some manufacturers use leaden vessels for this purpose.

Sulphuric acid is employed extensively in bleaching, with the oxyammoniacal acid, and in dyeing. It is the cheapest and most useful acid for cleaning the surface of plates of silver, copper, and iron, by dissolving their oxyds.

The sulphuric acid is said to have been found by Balassari, in a concrete state, lining a grotto in mount St. Amiato, in Tuscan: it also occurs in the crevices of volcanic mountains, and dissolved in some mineral waters. But the sulphuric acid of commerce is obtained either from the distillation of sulphate of iron, or from the combustion of sulphur. We shall here subjoin a brief account of both methods, referring to Aikin's Dictionary of Mineralogy, &c. for farther particulars.

Sulphate of iron, or green vitriol, consists of sulphuric acid, water, and oxyd of iron: by proper methods, the acid may be separated from the other ingredients of the salt; and this continued to be the only origin of sulphuric acid in the great way, till the discovery, by the manufacturers of English chemicals, of the art of preparing it by the combustion of sulphur. As this latter discovery has not, however, as yet entirely superseded the former, we shall give an account of both, beginning with the most ancient.

Sulphuric acid is thus prepared at Bleyl, in Bohemia. A long horizontal furnace or gallery of brick-work is constructed, capable of receiving a number of retorts: the retorts themselves are pear-shaped vessels, with a slightly curved neck, by which they fit into earthen receivers ready of the form of common retorts. The whole apparatus being prepared, each retort is charged with three pounds of sulphate of iron, previously calcined at a full red heat, and the fire is lighted. The first effect of the heat is to drive off the moisture absorbed by the vitriol in the interval between its calcination and distillation: this phlegm, being only very slightly acridious, is allowed to escape; and when it ceases to come over, the receiver with a little water in it is luted on to the retort. The fire is now raised, and kept up for 34 hours, during which time the acid rises in the form of dense white vapours, which fill the receiver, and are then absorbed by the water, and the fumes being at a high temperature, soon render the receiver very hot: hence the workmen judge of the termination of the process, by the receiver becoming cool, in conformance of the vapour ceasing to rise. The red oxyd of iron, or colcothar, is now taken out of the retort, and its place is supplied with a fresh charge of calcined vitriol: the distillation then takes place as already described, except that the former produce of acid is not emptied out of the receiver, and, therefore, there is no occasion to add any water. If the retort is well made, and carefully lubricated over, it will last for three successive distillations, and the quantity of acid obtained is nearly equal to half the weight of the calcined sulphate.

If the acid be examined at different periods of the distillation, it will be found to be more and more dense, according to the violence of the fire required for its extraction: the latter portion, if received in a separate vessel, will generally congeal upon cooling; hence it is called glacial sulphuric acid.

This acid used to be, and perhaps in still, prepared at Nordhausen, in Saxony: it is of a dark brown colour, and exhalates, when exposed to the air, abundance of dense, white, suffocating vapours; its usual specific gravity is \( \approx 1.95 \). For other properties, see Aikin, \( \text{aki} \) supra.
SULPHURIC ACID.

From the facts which he has recited it seems probable, that the essential difference between the common and glacial acid is, that the latter, from the mode in which it is prepared, contains a smaller portion of water than the former, and that to this is owing both its volatility and property of congealing. It is incidentally mixed with sulphurous acid, but the presence or absence of this does not appear to be of any material importance.

The sulphates of copper and zinc have occasionally been employed, instead of the sulphate of iron, but with a manifest disadvantage, both because they are dearer than the latter salt, and because they require a higher and longer continued heat to drive off the whole of the acid.

The following is the usual method of manufacturing sulphuric acid from the combustion of sulphur. A chamber is constructed of frame-work, and lined with strong sheet-lead; the only aperture is a small door, made to shut very close, the bottom of which is a little higher than the floor of the chamber. Water is poured into this chamber, till it rises to the height of an inch or two upon the floor, and a flame is introduced, on which is placed an earthen pot containing a few pounds of sulphur and nitre, in the proportion of from eight to ten of the former to one of the latter. This mixture is set fire to by means of a red-hot iron, and the door is immediately closed. At the expiration of about six hours, a second charge of sulphur and nitre is introduced, which after a similar interval is replaced by a third, and so on without interruption for a fortnight or three weeks. At the end of this period, the water in the chamber is sufficiently acidulated; it is accordingly transferred to a leaden boiler, where the greater part of the water is evaporated. In proportion, however, as the acid becomes more concentratated, it is more disposed to corrode and dissolve the lead of the boiler; therefore, before this degree of concentration takes place, the liquor is transferred into large green glass retorts, where a degree of heat is applied sufficient to drive off almost the whole of the water. As the acid becomes stronger, it also becomes clearer and less coloured, in consequence of a portion of acid re-acting on the impurities with which it is tinged, and thus destroying them. When the acid is thus brought to the required density and clearness, it is poured out of the retorts into large globular glass bottles, surrounded with wicker-work stuffed with straw, called carboys, and is then brought into the market, under the name of oil of vitriol.

The sulphuric acid obtained from the distillation of green vitriol exists ready formed in the falt; its extraction is a perfectly simple process, and the only impurities that it can possibly contain are sulphurous acid, and a very minute portion of oxvd of iron, and of the earth of the retort. When loaded with sulphuric acid, it has a suffocating odour, and, when exposed to the air, gives out a white vapour like strong muriatic acid. It need formerly to be sold in this state by the name of fuming oil of vitriol, and was further distinguished by its property of congealing into a soft ice, and a very moderate degree of cold. By dilution with a little water, and subsequence boiling for a few minutes in a glass vessel, the sulphuric acid is driven off, and the residual fluid is common sulphuric acid in a state of very considerable purity.

When the method of producing sulphuric acid by the combustion of sulphur and nitre was first discovered, the apparatus employed was a series of very large glass balloons, set at the bottom of each of which was a little water to condense the vapour; only a small quantity of the mixture could be burnt at once, and constant superintendence was necessary to supply the balloons with fresh charges of the materials. In order to save much of this manual labour, and the heavy loss arising from the frequent fracture of the vessels, leaden chambers were made use of, which, besides requiring less attendance, and being upon the whole cheaper, rendered it easier for the manufacturer to extend his establishment to any required magnitude. These chambers are of various construction: the most simple and in most general use are furnished only with two apertures, one small door, by which the water and the sulphur and nitre are introduced, and a leaden pipe with a stop-cock, by which the water, when acidulated, is drawn off: other chambers have besides a few small apertures, for the introduction of atmospheric air during the combustion, and a steam-pipe connected with a boiler, it being found that if the water is introduced in the state of steam, a much more rapid condensation of the acid ensues than in the usual way of proceeding. In some of the beetle contrived chambers, the combustion of the nitre and sulphur is effected in a separate flow, and the acid vapour thus produced is poured by means of a pipe into the condensing chamber.

There is a good deal of difference among the manufacturers as to the proportion of nitre employed: by some it is made equal to one-fifth of the sulphur, while by others it is not allowed to exceed one-tenth. This, however, appears to be satisfactorily established, that within the above limits the greater the proportion is of nitre, the more easily and more perfectly the acid is condensed. The less the nitre, the less the fume; and the less fume, the less the yield of acid. The nitre exceeding one-fifth of the sulphur, the combustion will be so rapid as to drive into the chamber a considerable proportion of sulphur unaltered. It would conduct much to the purity of sulphuric acid, and might probably be found even to be an economical plan, to line the chamber with glass instead of sheet-lead: the general appearance of the chamber would then resemble a green-house, and all the work-work should be faced internally with glass. A composition of wax, malein, and fine sand, would form a strong cement for the glass, and little liable to be acted on by acid vapours. More especially if the interfaces filled up with it were dunted with powdered glass, or very fine sand, while the cement was yet warm and adhesive. Such a chamber would have the additional advantage of allowing the operator to see what was passing within, without the necessity of opening the door.

The common English sulphur is unfit for the preparation of sulphuric acid, on account of a yellowish-brown colour which it gives to the fluid, and which it is not easy to get rid of. For this reason, the refined Sicilian sulphur is the only kind that is employed in this manufacture, at least in Britain.

Common sulphuric acid may be freed from the sulphates of lead and potash, which it generally contains, by distillation. This, however, though apparently a very simple process, is rather a nice matter to manage, according to the usual method. Sulphuric acid is not capable of being distilled at less than a red heat: when, therefore, the dense hot vapour first comes in contact with the necks of the retort and receiver, it is apt to break them, unless the precaution has been taken of thoroughly heating them by means of a pan of charcoal placed beneath, a minute or two before the distillation commences. All this risk, however, may be avoided, and in some laboratories it actually is so, by connecting the glass body, in which the acid is boiled, with the receiver, by means of a tube of platinum. Boiling sulphuric acid has not the least action on this metal, and the vapour, in its passage through, becomes so far cooled and condensed, that it flows into the receiver in drops.
SULPHURIC ACID.

Sulphuric Acid, in the Materia Medica, is a valuable tonic, astringent, and antiseptic. Its official preparations are the following: \textit{vis. Acidum sulphuricum dilutum; acidum sulphuricum aromadictum; acid. citricum; acid. muriaticum; acid. nitricum; aqua super-carbonatis potassii; fulphans potassii; pectina; soda; muriaria; antimonii; ferri fulgur; hydrazoammonitum; fulphants hydrazoammonitum; zinci fulphas; and other sulphuricos.}

The \textit{acidum sulphuricum dilutum}, or diluted sulphuric acid of the Lond. Ph., is obtained by adding a fluid-ounce and a half of sulphuric acid gradually to 14 fluid-ounces and a half of distilled water, and mixing. The Edinb. Ph. directs one part of sulphuric acid to be mixed with two parts of water. The Dubh. Ph. orders 2 oz. by weight of sulphuric acid to be mixed gradually with 14 oz. by weight of distilled water, and the mixture to be set aside to cool; then the clear liquor to be poured off. The fp. gr. of this acid is to that of water as 1900 to 1000. The tonic and anti- septic powers of this acid render it extremely serviceable in low typhoid fevers, dyspeptic affections, diabetes, convulsions, and in cutaneous eruptions. It restrains the colliquative sweats which attend hectic; locally applied, it is a common and useful adjunct to gargles in coryza, and to check catarrh; and as a refrigerant, it is given with certain benefit in phthisic hemoptyses, from whatever part they may arise. In the first-mentioned cases the diluted acid may be combined with infusions of cinchona or other vegetable bitters, and aromatics; and in the latter, with infusion of roes, mucilage, or simple water sweetened with syrup. The usual dose is from \textit{m}, x to \textit{m}, xxx, but in malignant erysipelas, with a tendency to hemorrhagy, it has been given to the amount of \textit{f} in twenty-four hours; and it has also been given with evident advantage, says Thomson, to the same amount, in violent uterine hemorrages.

The \textit{acidum sulphuricum aromadictum}, or aromatic sulphuric acid of the Edinb. Ph., is prepared by dropping 6 oz. of sulphuric acid gradually into 2 lbs. of alcohol; digelling the mixture in a covered vessel with a very gentle heat for three days; then adding of cinnamon bark, bruised, \textit{f}, oz. and ginger root, bruised, 1 oz.; digelling again in a clove vessel for six days, and filtering through papers placed in a glass funnel. The colour of this oil, which is generally regarded as an imperfect ether, is peculiar and aromatic, and its taste grateful and pleasant (\textit{f}); it is limpid, and of a brownish colour. This is an agreeable mode of exhibiting sulphuric acid in dysepsia, chronic asthma, and most of the complaints for which the diluted acid has been found serviceable. The dose may be from \textit{m}, x to \textit{m}, xxx in bitter infusions, or any convenient fluid vehicle, given three or four times a day.

The \textit{acidum citricum}, or citric acid of the London Ph., is obtained by taking of lemon juice a pint, sparked chalk an ounce, or a quantity sufficient to faturate the juice, and nine fluid-ounces of diluted sulphuric acid: add the chalk by degrees to the lemon juice heated, and mix them; then pour off the liquor. Wash the citrate of lime which remains in repeated portions of water, and then dry it. On the dried powder pour the diluted sulphuric acid, and boil for ten minutes; express the liquor strongly through a linen cloth, and filter it through paper. Evaporate the filtered liquor with a gentle heat, so that crysals may form as it cools. To obtain the crysals pure, dilute them in water a second and a third time; filter each solution, boil it down, and put it apart to crystallize. (\textit{See Citric Acid.}) The solution of this acid in water, in the proportion of \textit{f}, of the crysals to \textit{m}, of water, answers nearly all the purposes of recent lemon juice, and is even preferable for forming the common effervescing draught with subcarbonate of potassa. A solution of \textit{f}, in \textit{m}, of water, sweetened with sugar that has been rubbed on fresh lemon-peel, forms a grateful refrigerant beverage, resembling lemonade, and equally useful in febrile and inflammatory complaints. It is probable that the crysallized acid may be equally useful in scurvy as the fresh juice of the fruit; but we have not heard whether this point has yet been ascertained.

\textit{Acidum muriaticum}, or muriatic acid of the London Ph., is prepared by taking of muriate of soda dried, 2 lbs.; \textit{f}, lb. of sulphuric acid; and 1 pt. of distilled water; first mixing the acid with half a pint of the water in a glass retort; and when the mixture is cold, adding to it the muriate of soda; pouring the remainder of the water into the receiver; and, having fitted to it the retort placed in a sand-bath, distilling over the muriatic acid into this water, with a heat gradually raised until the retort becomes red-hot. The specific gravity of muriatic acid is to that of distilled water, as 1.170 to 1.000. The Edinb. Ph. directs to take of muriate of soda, 2 lbs.; of sulphuric acid, 16 oz.; and 1 lb. of water: first expose the muriate of soda in a pot to a red heat for a short time, and when it is cold, put it into a retort; then pour the acid, mixed with the water and cooled, upon the muriate of soda; and, finally, distill from a sand-bath with a moderate fire as long as any acid comes over. The Dubh. Ph. directs to take of muriate of soda, dried, sulphuric acid, and water, of each fix pounds; to dilute the acid with the water, and after it is cold, to add it gradually to the muriate put into a glass retort; then to distil the liquor until the residuum becomes dry. (See \textit{Muriatic Acid.}) This acid is tonic and antiseptic. It has been efficaciously used in typhus fevers, and in some cutaneous eruptions. It is a common and useful adjunct to gargles, in the proportion of from \textit{f}, to \textit{f}, in \textit{f}, of any fluid, in ulcerated fore- throats, and cancerous oes; and, in a very highly diluted state, \textit{f}, in \textit{f}, of water, it has been recommended as an injection in gonorrhoea.

This acid has even been regarded as an antitoxin in general phthisical affections; but the observations of Mr. Pearson have shewed this opinion to be erroneous; yet, by its salutary effects on the stomach and general health, "it is a medicine capable of ameliorating the appearance of venereal ulcers, and of restraining for a time the progress of the disease," where it is desirable to "gain a little time, previously to the entering on a mercurial course." The dose is from \textit{f}, to \textit{f}, in \textit{f}, of a sufficient quantity of water.

A very important property of muriatic acid, in the state of gas, is the power it possesses of neutralizing putrid miasms, discovered by Moreau in 1773. It is, therefore, used as an agent for destroying infection in sick rooms and hospitals, dilengaged by pouring sulphuric acid on common salt.

\textit{Acidum nitricum.} (See \textit{Nitric Acid.}) For the other articles above enumerated, see \textit{Antimony, Iron, Mercury, Potassium, Salts, Sulphate, &c.}

For an account of the \textit{ether sulphuricos}, or sulphuric ether, see \textit{Spirit.}

The ethereal oil of the Lond. Ph. is prepared in the following manner. After the distillation of sulphuric ether, distill again the remaining liquor with a gentle heat, until a black froth swells up; then immediately remove the retort from the fire. To the liquor in the retort add water sufficient, that the oil may float upon it. Let this be scummed off, and as much lime-water be added to the retort as will raise any acid it may contain; and shake them together. Lastly, take off the ethereal oil after it is separated. The oily ethereal liquor of the Dubh. Ph. is obtained by taking what remains in the retort after the distillation.
SULPHURIZED MURIATIC ACID, a fagicular compound resulting from the incomplete oxygenation of the sulphur when exposed to the long continued action of oxymuriatic acid, by which it is converted into sulphuric acid; the properties of which have been only examined by Dr. Thomson. It is thus prepared: Char a retort with common salt and oxys of manganese; to it a Woulfe's apparatus, with two or three bottles; put some dry leaves of sulphur into the first bottle, and into the next some bexomated potash, to absorb the superfusible acid: then pour into the retort some concentrated sulphuric acid, and oxymuriatic acid gas will be immediately liberated. After the sulphur has been for some time in contact with this gas, it will become moist and doughy, its colour will change to orange, by degrees it will become more and more soft, and at length will be resolved into a red fluid: so soon as this is effected, the process must be stopped.

The liquid thus obtained is perfectly clear, of a colour between scarlet and crimson, by reflected, and green by transmitted light; its specific gravity is 1.63, and its weight is more than twice that of the sulphur employed. When first exposed to the air it smokes like the distilled muriate of tin, but after a time its fumes are not more copious than those from strong muriatic acid. It is very volatile at a moderate temperature. Its odour resembles that of sea-weed, but is much stronger, and it affects the eyes in the same manner as wood-smoke does. Its taste is acid, hot, and bitter. It changes paper stained with vegetable blues to red, but not very rapidly, unless water is added.

This fagicular substance has not yet been very exactly analysed; nor does it appear to be uniform in its composition; in one specimen Dr. Thomson found the relative proportions of muriatic acid and oxys of sulphur to be as 44 of the latter to 35 of the former. In another specimen the proportions were 47.1 muriatic acid, 35.5 oxys of sulphur, and 4 sulphuric acid. The oxys of sulphur appears to be composed of 53.6 sulphur, and 6.2 oxygen. Aikin.

SULPHUROUS or SULPHUROUS, is formed when sulphur is burnt in the open air. At the common temperature it exists in the gaseous form. It is the peculiar fagocating effects of this gas that we feel when the sulphur burns. The first chemist who seems to have examined this acid with any attention was Stahl, who named it "phlogiilicated vitiolic acid." Our knowledge of it was enlarged by Scheele, Priestley, Berthollet, Vaquelin, and Fourcroy; but we are indebted to Dr. Thomson for the best analyses of it that has yet appeared, and for the discovery of various interesting facts, which had been either overlooked or obscurely stated by preceding inquirers. The most simple way of obtaining this gas is by heating sulphuric acid with mercury, or bits of copper, in a glass retort. If the neck of the retort be placed under a receiver filled with mercury, in a mercurial bath, the gas will be obtained.

It is elastic and colourless, like air. Its smell is pungent and fufing, it is insoluble in water, it is inflammable, and supports combustion or animal life. It first reddens vegetable blues, but ultimately destroys their colour. It is employed for destroying the colour of silk, wool, and hair. These bodies are exposed to the fumes of burning brimstone, which is the cheapest way of forming this gas. This process is called flowery. Accordingly these forms are employed to discharge the natural yellow tinge from white woolen cloth, and to refine silk that has become yellow by long wearing, to its original whiteine; it is also used to check the fermentation of vinous liquors. Its specific gravity is easily known, when we learn that oxygen is converted into sulphurous acid without changing its volume, and it takes up its own weight of sulphur. Hence the specific gravity of oxygen is doubled, and the specific gravity of sulphurous acid gas is to that of hydrogen, as 1 to 30, which agrees with experiment, or about twice as great as that of atmospheric air. (See Gas.) Water absorbs about 30, or, as others say, 20 times its bulk of this gas, to which it communicates a disagreeable taste and the smell of the gas. The gas is expelled by heat; but if they remain for some time exposed to the air, the smell vanishes from the absorption of oxygen, which converts the sulphurous into sulphuric acid.

It does not appear susceptible of any change by heat; but, according to an experiment made by Monge and Cloutet, if exposed at the same time to great prelure, and a cold equal to 31° of Fahrenheit, it looses its elasticity, and assumes a liquid state. Water, it is said, by simple exposure to this gas, without agitation or extraordinary prelure, absorbs, according to Priestley, about 44 times its bulk, or 4/5 of its weight; and, according to Thomson, at 51° Fahr., 33 times its bulk, or 4/5 of its weight; but if water be saturated by this gas, by means of a Woulfe's apparatus, the bottles of which are surrounded with ice, it will be found to have taken up, according to Vaquelin, about 4/5 of its weight. The specific gravity of this liquid acid is flated by Berthollet at 1.04, and by Vaquelin at 1.03; by Thomson at 1.05 at 68°.

We may learn from what has been observed, that this acid is constitute by one atom of sulphur 15, and two atoms of oxygen 15; the weight of its atom being 30.

From Dr. Thomson's analysis it appears that 82 parts of sulphuric acid, and 18 of sulphur, constitute 100 of sulphurous acid; according to which (if the analysis of sulphuric acid by Chenex be assumed the most authentic) this acid consists of

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The order of the affinities of sulphurous acid, as far as it has been ascertained, is the following: barytes, lime, potash, foda, magnesia, ammonia, and alumine. It is separable in the form of gas from its earthly and alkaline bates, by the sulphuric, muriatic, phosphoric, and tartaric acids. Oxigenous gas seems to have no effect on sulphurous acid gas, when both ingredients are dry; but if to a mixture of one part of the former and two of the latter, a little water be added, a sudden diminution of bulk will at first take place, on account of the absorption of part of the acid gas by the water; after which a gradual absorption occurs, in consequence of the process of an actual combination between the two gases, by which sulphuric acid is formed, and part of the oxygen gas disappears. Oxymuriatic acid gas is readily decomposed by sulphuric acid; the vessel is filled with white vapours, and a mixture of sulphuric and muriatic acids is the result.

Hydrogen gas and sulphuric acid exercise no action on each other at the common temperature, but if a mixture of three
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three parts, by bulk, of the former, and one of the latter, is
made to pass through a red-hot glass tube, the sulpheric
acid is totally decomposed, and the products are sulphar,
water, and sometimes a little sulphuretted hydrogen.
Phosphorus, even when strongly heated in a glass tube,
appears to have no action on sulpheric acid gas. Phos-
phuretted hydrogen, on the contrary, even at the ordinary
temperature, readily decomposes this acid; the mixture
looses its state of elastic fluidity, a white vapour makes its
appearance, and the fides of the vessel are lined with a mixture
of sulphur and phosphorus. Sulphuretted hydrogen has a
similar effect to phosphuretted hydrogen, and sulphur is pro-
duced from the decomposition both of the acid and of the
inflammable gas.
Charcoal, at the common temperature, imbibes a con-
siderable quantity of sulpheric acid gas, but appears to
produce no material change upon it; at a red heat, however,
the gas is decomposed, sulphar is deposited, and phos-
phuretted hydrogen is produced; the hydrogen, doublets, or
originating from the water, either of the acid gas or of the
charcoal.

White camphor, sulpheric acid combines readily, and
the result is a liquid, the properties of which have been but
little investigated; this compound, when dropped into
water, precipitates again the camphor, which appears to have
undergone scarcely any alteration.

Sulphuric acid, especially at a low temperature, absorbs
a large proportion of sulpheric acid gas; the combination
soon becomes solid, and in this state it has but little odour;
but if a portion be laid on a piece of glass, and exposed to
the air, it presently resolves into a liquid, at the same time
dissolving, with a very visible effervescence, the greatest
part of the sulpheric gas. Strong and colourless nitrte
acid, by being impregnated with sulpheric acid gas, ac-
quires a deep orange tinge, and nitrous gas is disengaged;
the sulpheric being at the same time converted into sul-
phuric acid.

Water, when saturated with sulpheric gas, forms the
liquid sulpheric acid; it is best prepared in a Woulfe's ap-
paratus, with two or more bottles, into the first of which
should be put a little water, to take up the sulpheric acid,
which the gas is generally more or less mixed, while the
purified sulpheric acid is absorbed by the water in the se-
cond and succeeding bottles. This liquid acid absorbs oxy-
gen from the air, and is gradually converted into sulpheric
acid. But if a little of it is confined in a glass tube, her-
metically sealed, and exposed to the common heat of a sand-
bath for a few weeks, the inside of the tube will be observed
to be lined by degrees with minute crystals; after a time the
deposition of crystals will cease; if then the end of the tube
be broken off under mercury, this latter fluid will rise
in the tube, showing that a portion of the air has disappeared,
and the residue, on examination, will be found to be wholly
deprived of oxygen; the liquid, which was pure sulpheric
acid, will be converted, for the most part, into sulphar,
and the crystals are sulphar. Hence it appears, that by
the long continuance of heat, the oxygen of the liquid sul-
pharic acid quits one part of its base in order to form sul-
phuric acid with the remainder.

Sulphuric acid combines, either directly or by com-
posed affinity, with the different saltifiable bases, forming
the genus of salts, which have obtained the name of
salts.

Those metals whose affinity for oxygen is weak, as lead,
mercury, and copper, are not acted upon by sulpheric
acid. Some metallic oxides simply combine with the acid
into a sulphate; others, as the black oxide of manganese,
give out a portion of oxygen to the acid, converting it
totally, or in part, to sulpheric. Hence there is produced a
sulphate, either mixed or not with a sulphite.

SULPHURWORT, MEADOW, in Agricola, the
common name of a plant of the grass kind, often met with
in meadows of the more moist description. See Hy-
Fennel.

SULPICIUS-SEVERUS, an ecclesiastical histori-
on, and prebiter of the fifth century, who is placed by
Cassius about the year 401, and who is supposed to have died
about the year 430. He was a native of Gaul, educated for the
bar, and became eminent for his eloquence. He acquired
wealth and married. After the death of his
wife, he took orders, and devoted himself to a religious
life, first under the discipline of Phebeanus, bishop of Ages,
and afterwards under that of St. Martin, bishop of Tours.
Paulinus, bishop of Nola, with whom he was intimate, makes
honourable mention of him in his letters. He died in
some time at Touloufes, and afterwards at Eauze, in Galla
Carsonnenses. Censorius says, that in his old age he em-
braced Pelagianism; but being convinced of his error, me-
nifested his repentance by perpetual silence afterwards; this
is, as some suppose, by writing no more books. It appear
from his own works, as well as from the testimony of
Jeron, that he imbued some of the notions of the Millenarians.
Du pin says that he was very credulous with regard to
 miracles; but Tillenouf believes every word. It is recorded,
much to his praise, that he was adverse to every kind of
persecution, and that he disapproved of the interposition of
miracles in the province of religion. His testimony in the
books of the New Testament is very explicit, and he con
firms many of the historical facts recorded in them. His ge-
neral division of the sacred writings is into the law, the
prophets, the gospels, and the apostles;—the law and the
apostles;—the Old and New Testament. He was the au-
thor of many works, the principal of which is his "Sacred
History," in two books, written in a neat and elegant Latin
style, bearing a comparison with that of the best classical
writers, and containing a full array of events in the affairs
of the Jews, and of the church, from the beginning of the
world to the confilhip of Stilicho and Aurelian, A.D. 400.
This history, after the period of the evangelical writings, is to
short, and even defective; the author having wholly omitted
the reign of the emperor Julian, and, as Dupin says, having
committed many faults against the truth of history, especi-
ally the ecclesiastical. He has also given an account of St. Martin,
bishop of Tours, and three letters on the death and virtues
of that saint, in which he has intermixed fables with many
peculiar curiosities. His most entertaining work is one of
his dialogues, which relates the mode of life of the cistercian
monks, and affords an instructive delineation of the state of
monachism at that period. Some epistles to his father and
other persons are also preferred. His works have been fe-
reral times republished. The best editions are those of Le
Clerc, Lipl. 1709, 8vo, and of Hieron. a Prato, Vern.

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SULTAN, or Soldan, a title or appellation given to the emperor of the Turks.

Baron de Tott says that it is a title given to the Polish princes, born while their fathers were in possession of the throne, and to those of the Gungushian family. It is bestowed, however, on the person who enjoys the rights of succession; and this, by the Turfik law, belongs to the eldest of the family, born while the father possesses the throne. But the baron is certainly mistaken when he affirms, that in Turkey or Tartary the title sultan conveys no idea of sovereign authority. The legend on the coin of the Turkish emperors, which begins with these words “Soultan el Beren,” sovereign of the earth, evinces the contrary.

It had its rise under Mahmoud, son of Sebecstehgin, the first emperor of the dynasty of the Gaznovers, toward the close of the fourth century of the era of the Hegira; when that prince going to Segesst to reduce Kalaf, governor of that province, who affected the sovereignty; Kalaf was no sooner advertised of his coming, than he went out to meet him, delivered the keys of his fortresses, and owned him his sultan; that is, his lord or commander. The title pleased Mahmoud so well, that he assumed it ever afterwards; and from him it passed to his descendants, and to other Mahometan princes.

Vatter will have the word Turfik, and to signify king of kings; adding, that it was first given the Turkish Agios, oxen and sheep; others will have it originally Persian, allying, in proof of it, an ancient medal of Cofcoe; others derive it from foldanum, quafo fial dominus; others from the Hebrew סלע, סכלא, to rule, reign.

In the Roman ceremonial, we also find mention made of a foldan, or marshal, who is to attend the pope when he marches in state. He is also to apprehend malefactors.

SULTANS, Epocha of the. See Gledaan Epocha.

SULTAN Flower, Cyanus, in Botany, a species of Centaurea, which see.

Sultana-Schrijf. See Schrijf.

SULTANA, the wife of a sultan.

Travellers, it is observed, have improperly called sultans the wives of the grand vizier; as this name is given in Turkey only to the princesses of the blood, daughters of a sultan, or to the mother of him who occupies the throne. The daughters of the sultans no longer bear any other name but that of "Kanoom-sultan." The grand vizier, either from pride or political motives, must not marry his subjects; he thinks himself too exalted above the rest of mankind to involve himself with a woman by the ties of marriage, and place her, in some measure, in the same rank as himself. He has an indeterminate number of female slaves destined to his pleasures, and to give him succourers. But among this great number, seven of them only, after having enjoyed more or less the favours of the sultans, are raised to a rank above the others; they become his favourites; they participate most commonly in his pleasures; and sometimes acquire no small degree of influence over public affairs. They are distinguished by the name of "Kadum." The slave who becomes the mother of a boy, or the favourite sultan, is called at Hahasti-sultan, i.e., the private sultana.

(See Arsh.) She has a hose and flaves; she obtains a distinguished rank; she is treated with the greatest respect; she enjoys a fort of liberty in the interior of the harem; and in a word, she approaches the sultan as often as she wishes, and is reckoned the emperor's chief wife, if this term may be used.

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She is likewise allowed a large revenue, and acknowledged in the seraglio as queen, by every expression of duty and respect. The other women (though they may have issue) are not called queens; but they are called sultanas, because they have had carnal commerce with the king; but they are not so honoured with the title of queen, who is the mother of the first begotten son, heir to the empire. If this son should die, the mother returns among the "Kadums," if he be not heir to the old seraglio, called "Eckli-sera," constructed by Mahomet II. (See SERAIL.) If another of the sultanas should have a second son; then her son being to succeed the deceased heir, she is immediately made queen, and the former shall remain a sultana only, and be deprived of her revenue and royalty; and thus the title of queen is transferred from one sultana to another, by virtue of the son's succession.

The mother of the new sultan, or reigning emperor, is called "Valadi or Valada sultana," has her liberty, a palace, and revenues. Greaves's Works, vol. ii. p. 648, &c. For an account of the condition and treatment of these slaves that are not selected among the favourites, see ODALITES.

SULTANA also denotes a strong Turkish vessel of war.

SULTANABAD, in Geography, an old city of Persia, in Khorasan. See TARSHISH.

SULTANABAD, a circuit of Bengal, bounded on the N. by Rajemal and Anmore, on the E. by Raujehy, on the S. by Birboom, and on the W. by Birboom and Hendosa; about 25 miles long, and 18 broad.

SULTANABAD, a large town of Persia, in the province of Kerman, situated at the foot of a pass on the banks of a fine river, and surrounded with gardens and cultivated lands. In its vicinity grows a tree, which produces a fruit, resembling in flavour the quince, but in appearance the coffee-berry.

SULTANGUNE, a town of Bengal; 14 miles W. of Boghipour.—Alfo, a town of Hindostan, in Oude; 40 miles W. of Lucknow.

SULTAN-HISAR, a town of Asiatic Turkey, in Natalia, once a strong place, a part of the citie of the ancient Tralles; taken in 1403 by Timur Bee; 52 miles S.E. of Miletas. N. lat. 37° 51'. E. long., 28° 4'.

SULTANI. See BJORE.

SULTANIA, or SULTANEE, an old city of Persia, in the province of Irak, said to have been built in the 13th century, on the ruins of the ancient Tigranocerta; the residence of many of the Persian kings, and one of the largest cities of Asia. It was taken and pillaged by Timur Bee, who nevertheless suffered the edifices consecrated to religion to remain. It is situated in a pleasant and fertile plain, where the king usually encamps during the summer months, in order to avoid the hot and unhealthy climate of Teksm. This city, which is 70 miles from Caffewen, and 300 from Meana, was the capital of the descendants of Holaku; but is now an entire mass of ruins; occupied by about 20 poor families, who live in wretched hovels, in the vicinity of the tomb of sultan Hodabunda, the founder. This is a large and beautiful structure, built of brick, and covered with a cupola, ninety feet high, that would do honour to the most scientific architect in Europe. The latitude of Sultanien was ascertained by several observations, whilst the millstone was encamped with the king in June 1810. The mean of these observations was 35° 52' 30" N. The longitude is said to be 48° 26'. E.

SULTANIA, or TURKISH SIAUN. See SIAUN.

SULTANPOUR, in Geography, a town of Hindostan, in the country of Lahore; 61 miles S.E. of Lahore. 3 T

N. lat.
N. lat. 50° 25'. E. long. 73° 30'.—Alfo, a town of Bengal; 53 miles S. of Calcutta.—Alfo, a town of Hindostan, in Gujarat; 30 miles S. of Goa.—Alfo, a town of Hindostan, in Oude; 50 miles N. of Allahabad. N. lat. 24° 13'. E. long. 82° 28'.

SULTE, or Sule, a town of Mecklenburg, containing some salt-works and boiling-houses; 23 miles E. of Rostock. N. lat. 54° 8'. E. long. 13° 40'.

Sultz, a town of France, in the department of the Upper Rhine, with a medicinal spring; 12 miles S.W. of Colmar.—Alfo, a river which rises in the county of Cilley, and runs into the river Save, 7 miles E. of Rein.

Sulz, or Sulz. See Sulz.

SULTZBACH, a town of France, in the department of the Upper Rhine; 6 miles S.W. of Colmar.—Alfo, a town of the duchy of Wurzburg; 9 miles S.E. of Lauingen.

SULTZBURG, a town of the duchy of Baden, celebrated for its wine; 20 miles N.E. of Bale.

SULTZDORF, a town of the duchy of Wurzburg; 4 miles S.E. of Konigshofen in the Grabfeld.

SULTZHEIM, a town of the duchy of Wurzburg; 2 miles N.N.W. of Gerothalm.

SULTZMACT, a town of France, in the department of the Upper Rhine; 9 miles S.W. of Colmar.

SULZEN, a river of European Turkey, which runs into the sea, 6 miles S. of Italic.

SULZ, a town of Germany, in the margravate of Anspach, on a river of the same name; 13 miles W. of Anspach.—Alfo, a river of Bavaria, which runs into the Altmahl, near Beringen.—Alfo, a river of Anspach, which runs into the Wormitz at Waffertudingen.—Alfo, a river of Helfe, which runs into the Fulda, two miles N. of Hursfeld.—Alfo, a town of Wirtemberg, near the Neckar, with ample salt-works; 12 miles N. of Rothweil. N. lat. 48° 18'. E. long. 8° 40'.

SULZA, a town of Saxony, in the principality of Weimar, on the river Ilm, near which are some silver-mines belonging to the prince of Saxe-Coburg; 14 miles N.E. of Weimar. N. lat. 51° 5'. E. long. 11° 42'.

SULZANO, a town of Italy, in the department of the Mela; 12 miles N.N.W. of Brescia.

SULZBACH, an imperial village of Germany, in the circle of the Lower Rhine, given in 1802, among the indemnities to the prince of Nassau-Ulimen.—Alfo, a town of Germany, in the lordship of Limburg; 5 miles E.S.E. of Galdorf.—Alfo, a river of Wurzburg, which runs into the Kirch, near Denkendorf.—Alfo, a town of Bavaria, and capital of a principality to which it gives name, united with Neuburg. It contains churches for the Luthers and Roman Catholics, and about 500 houses. In the neighbourhood is an iron-mine. The tax to the chamber of Westfals was 48 m. dollars 51 kreutzert; 48 miles N.N.E. of Ingolstadt. N. lat. 46° 50'. E. long. 11° 45'.

—Alfo, a town of France, in the department of Mont Touerere; 3 miles N.W. of Latereck.

SULZBURG, a town of Bavaria, lately belonging to the abbey of Kempten; 6 miles S. of Kempten. N. lat. 46° 51'. E. long. 11° 47'.

SULZBURG, Obir, a town and citadel of Bavaria, and capital of a lordship to which it gives name, united with Pyrbaum; 29 miles W.N.W. of Ratibon. N. lat. 49° 8'. E. long. 11° 20'.

SULZER, JOHN-GEORGE, in Biography, was born in 1720 at Winterthur, in the canton of Zurich, and being the youngest of twenty-five children, and having loft both his parents in the same day in the year 1734, his patrimony was scarcely sufficient for defraying the expense of his education. In 1736, however, he was sent to the gymnasium of Zurich, where he was principally indebted for instruction to John Gellner, and also to Bournier and Breitinger, who formed and directed his taste. At this time his attention was divided between the study of the Hebrew language, Wolff's philosophy, and the system of Linnæus. In 1739 he was licensed to preach by the synod of Zurich. His first publication was entitled "Moral Considerations on the Works of Nature;' and his account of a tour which he made in 1742 into the neighbouring part of the Alps was printed. In 1745 he visited Berlin, and there gained the friendship of Euler and Maupertuis; but during his previous residence at Magdeburg he edited a translation of "Schlocher's Itinera Alpina," and wrote his "Treatise on the Education and Instruction of Youth." On the recommendation of Sack and Euler of Berlin, he was appointed professor of mathematics in the Joachimsthal college at Berlin. Having obtained leave from the king in 1750 to visit Switzerland, he married a lady to whom he had formed an attachment at Magdeburg. He then accompanied Klopfrock to Zurich, and on his return to Berlin in the same year, he was made a member of the Royal Academy of Sciences, to the philosophical clafs of which he contributed various psychological essays, which were afterwards translated into German, and published in a separate volume. In the year 1760 he had the misfortune to lose his wife, after which event he never entirely recovered his strength and spirits. In order to dispense his grief, he was allowed, in 1765, to revisit his native country, where he employed his time in completing his "Theory of the Fine Arts." In 1765, on his return to Berlin, he obtained the king's consent to resign his professorial chair, and resolved to retire with his two daughters, not yet of age, to the vicinity of Zurich, and there calmly to wait the approach of death. But the king retained him at Berlin, and granted him a pension, with a professor's chair in the Knights' academy, then newly established. He also granted him a piece of ground on the banks of the Spree, near the city, where he might erect a house, and amuse himself with gardening, of which he was exceedingly fond. In this spot he spent the happiest period of his life, from the year 1765 till his death. His employment, besides that of writing, was the superintendence and occasional inspection of schools and gymnasia in the king's dominions. In 1768 he published, for the use of schools, "Exercises to excite Attention and Reflection," and "Observations on the reciprocal Influence of Reasons in Language, and of Language on Reason." In the next year he committed to the press his excellent "Dictionary of the Fine Arts:" the first part of this work appeared in 1771. In the same year Sulzer made an attempt in dramatic writing, and prepared Mercier's "Defensor," the Berlin theatre: he also endeavoured to convert Shakspere's "Cymbeline" into a regular piece for the same purpose; but his talents did not appear suited to this kind of composition. In 1771 he was invited by the duke of Courland to Mihen to establish a new gymnasium, which proposal his bad health obliged him to decline, though he drew up the plan of the establishment, and made efforts for procuring able professors. In 1772 the state of his health prevented the discharge of his professional duty in the military school. In order to obtain relief in his malady, he undertook, by the advice of Haller, a tour to Nice, an interesting journal of which has been printed. In the course of this journey he received the last proof of the effem of his sovereign, in the intelligence that he was appointed director of the philosophical clafs of the academy. The mild climate of Italy proved a
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first favourable; but in the autumn of 1776 his complaints increased; and in 1777, after his return, he had an interview with the king. On the day before his death he was very cheerful, and conversed freely with his friends; and when one of them said that he hoped to see him again, he replied, with much composure; “Yes, I hope to too; without this hope, life would be a miserable dream.” He expired, as if falling asleep, in the month of February 1779.

SULZFIELD, in Geography, a town of the duchy of Wurzburg; 5 miles S.S.W. of Kitzingen. N. lat. 49° 43'. E. long. 8° 30'.

SULZHEIM, a town of the duchy of Wurzburg; 7 miles S.E. of Schweinfurt.

SUM, SUMMA, in Mathematics, signifies the quantity that arise from the addition of two or more magnitudes, numbers, or quantities, together.

This is sometimes called the aggregate; and, in algebra, it is sometimes denoted by the letter Z, which stands for summa or sume; and at other times by the letter S.

Sums of an Equation is when the absolute number being brought over to the other side, with a contrary sign, the whole becomes equal to 0: this Descartes calls the sum of the equation proposed.

SUMA, a name given by some of the chemical writers to tartar.

SUMACH, in Botany. See RHUS.

The ancients used sumach, instead of salt, for seasoning their meat; whence the Latins call the tree ribes obovatum; and from its use in dressing of leather, it has been called ribes coriaria.

SUMACH, Myrtle-leaved. See CORIARIA.

SUMADA, in Geography, a town of Switzerland, in the Upper Engadine; 8 miles S.W. of Zulm.

SUMAGA, a town of Italy, in the Friuli; 3 miles W. of Concordia.

SUMAGE, SUMAGHUM, or Sumagham, in our Old Writers, toll for carriage on horseback. “Pro uno equo portante summagium per dimidium ann. abolum.” Chart. de Foresta. 215.

SUMAN, in Geography, a town of Hindoozab, in the Dooob; 10 miles N.N.E. of Esfah.

SUMANSTOWN, a village of Pennsylvania, in Montgomery county; 37 miles N.W. by N. from Philadelphia.

SUMARA, a mountain of Arabia, in Yemen; 6 miles S.W. of Jerim.

SUMAR, in Mythology, a sort of flute with two pipes, one of which, the shorter, is used for playing airs, and the longer, in a continued blast; just like the long pipe in the Bulgarian bagpipe. In Egypt they have a bagpipe, called “Sumara el Kurb;” but this is not equal to the Bulgarian bagpipe, which affords the finest music ever heard by Niebuhr in Turkey.

SUMAS, in Geography, a town of New Mexico; 390 miles S.S.E. of Santa Fé. N. lat. 30° 50'. W. long. 105° 36'.

SUMASINTA, a town of Mexico, in the province of Tabasco, on a river of the same name; 115 miles S. of Campeachy. Also, a river of Mexico, which rises about 200 miles S. of Zacualpa, in the province of Chiapas, and runs into the bay of Campeachy, N. lat. 18° 30'. W. long. 90° 40'.

SUMATI, in Hindu Mythology, is the name of a beautiful damsel, espoused by Sagara; the latter being, like Samadra, a personification of the seas. She is said to be the father of Supern, the animal half eagle half man, on which the god Vehu rides. A most extravagant legend, in which, perhaps, is buried some historical or physical fact, is related of this damsel in the Ramayana, and in other Hindoo venerated books.

Being childless, she and her husband engaged, as is usual, in a course of sacred austerities, and was rewarded by a choice given her by the gods, of having one or sixty thousand sons. She preferred the latter, and brought forth a gourd (capsa his lagernaria), whence issued that number of male children, who were carefully brought up by their nurses in jars of butter. This will suffice to all the monstrous legends of Hindoo romance. Some something farther of this story, on which hinges a great deal of incident, probably historical, highly embellished by poetical exaggeration, is noticed under our article SUPERS.

SUMATRA, in Geography, an island in the East Indian seas, the most weedy of those demilitarily Sunda islands, and constituting, on that side, the boundary of the Eastern Archipelago. Its general direction is nearly N.W. and S.E. It is divided by the equator into almost equal parts, one extremity being in 5° 33' N. and the other in 5° 36' S. lat.

Fort Marlborough, on the point of land called “Ooong Carrang,” in S. lat. 3° 46', the only place whose latitude has been determined by actual observation, is found to lie 102° E. of Greenwich; but the situation of Acheen Head is also pretty accurately fixed by computation at 95° 34'; and the longitudes in the fratries of Sunda are well ascertained by the short runs from Batavia, which city has the advantage of an observatory. Sumatra lies exposed on the S.W. side to the Great Indian ocean; the N. point stretches into the bay of Bentara; to the N.E. it is divided from the Malay Peninsula by the fratries of Malaca; to the E. by the fratries of Banca, from the island of that name; to the S.E. by the commencement of the Chinifea seas; and on the S. it is bounded by the fratries of Sunda, which separate it from the island of Java.

Some traditions report that Sumatra was anciently a part of the continent of Asia. John De Barros speaks of it as the Aurea Chersonesus of the ancients, conceiving it to be a continuation of the continent; and another writer describes the fratries of Malaca as a large river. This large island seems to have been utterly unknown to the Greek or Roman geographers, whose discoveries, or rather conjectures, extended no farther than Ceylon, which was probably their “Taprobane.” The idea that Sumatra was the country of Solomon’s Opheir, is too vague to merit discussion. (See OPHEIR.) The Arab travellers, who, about the year 1173, penetrated into India and China, mention an island, which they call “Ramni,” with which the situation and productions of Sumatra tolerably coincide. Marco Polo, whose writings published in 1299, though condemned as fabulous, bear many signatures of authenticity, describes an island called “Java Minor,” which was probably Sumatra. The name of Sumatra is not much known; the orthography of it is various, is of uncertain etymology. The appellation Samader, given to this island, has some resemblance to Sumatra; but the Nubian geographer, Edrisi, describes it as lying near to the river Ganges. M. d’Anville is confident, that the “Jabaddi infula” of Poloemy is Sumatra, though usually supposed to represent Java. The commentators of Arrian assert that this is the island meant by the “Infula Simundii,” or “Palesimundii,” of that writer, in his “Periplus Mani Erethret.” A friar named Odoricus, who in 1311 visited some of the Indian islands, speaks of Java and “Symolza,” which perhaps may suggest the true etymology of Sumatra. Reland thinks, that Sumatra owes its name to “Samadra,” supposing him to signify, in the language of the country, “magna forma,” from the large
ants which abound in that country; but as there is no remarkable hill that bears the appellation which he mentions, this etymology is not probably correct. The name, whatever be its origin, seems to have been acquired by the Portuguese on the coast of Malabar, where they made their first establishments, and obtained a knowledge of the more eastern countries.

Sumatra, according to Mr. Marfiden's statement, is one of the largest islands in the world; resembling Great Britain more perhaps in size than in shape, though, like Great Britain, it is broadest at the southern extremity, and narrows gradually towards the north. A chain of mountains runs through its whole extent, in some parts double, and in others treble; but situated, in general, more to the western than the opposite coast, and being on the former seldom so much as 20 miles from the sea. The height of these mountains, though very great, is not sufficient to allow their being covered with snow, during any part of the year, which is the case with those of South America, between the tropics. (See Ophir.) Between the ridges of these mountains are extensive plains, elevated, however, considerably above the surface of the maritime coasts, where the air is cool, and affording the most eligible situation for inhabitants, who are here the most numerous, and spots the moat cleared of woods, which in other parts of the island cover the hills and plains with a perpetual shade. Here are also many large and beautiful lakes, that extend at intervals through the whole country, forming a communication between the different parts, and furnishing most of the larger rivers, those especially that discharge themselves to the eastward. Waterfalls and cascades are also not uncommon. The country is everywhere well watered, and abounds with springs; and on the western coast the rivers are innumerable, but too small and rapid for the purposes of navigation. The heat of the air is less intense than might be expected, in a country occupying the middle of the torrid zone; the thermometer, at the most sultry hour, or about two in the afternoon, generally fluctuating between 83 and 85 degrees. At full tide it is usually as low as 76; but in the off season it is much more perceptible than usual, a temperature would seem to indicate. Inland, as the country ascends, the degree of heat decreases rapidly, requires the warmth of fires, and checks the vegetation of the cocoa-nut tree. The temperature of this island is not unreasonably ascribed to its narrow form. Frost, snow, and hail, are totally unknown to the inhabitants. The atmosphere, however, is in common more cloudy than that of Europe; and between the hills, a fog, called "caboot" by the natives, is dense to a surp passing degree; it rises in the morning, and is seldom dispersed till about three hours after sun-rise. The water-spout is a phenomenon that frequently occurs; and thunder and lightning are very common; and during the north-west monsoon, the explosions are extremely violent. On the west coast of Sumatra, the south-east monsoon, or dry seaon, begins about May, and slackens in September; the north-west monsoon begins about November, and the profuse rains cease about March. The monsoons, for the most part, commence and subside gradually there; the months of April and May, October and November, generally affording weather and winds variable and uncertain. The soil of Sumatra may be represented generally as a stiff, reddish clay, covered with a stratum or layer of black mould, of no considerable depth. Its population being thin, it happens that at least three parts in four of the island, and towards the south much a greater proportion, remains an impervious forest. Along the western coast swamps abound, and have a considerable extent, and surround spots of land, which become so many islands and peninsulas, of various elevation. This unevenness of surface has been ascribed to various causes; but Mr. Marfiden inclines to trace its origin to the springs of water with which these parts of the island abound, and which are themselves owing to the loftiness of the ranges of mountains that occupy the interior country, and interrupt and collect the floating vapours. The earth is rich in mineral and fossil productions. It affords, even in its present exhausted state, a considerable quantity of gold, copper-mines of very rich ore, iron-ore, tin, sulphur, salt petre, coal, and rock-crystal. Mineral and hot springs have been discovered in many districts; and also earth-oil, soft rock, called "nappal," and polishing the qualities of the steatite. The mountain fone is a species of granite. Many curious fossils are discovered in cliffs, occasioned by the encroachments of the sea, such as petrified wood, and sea-shells of various sorts. Here are also various kinds of coloured earths.

In this, as well as all the other islands of the eastern Archipelago, there is a number of volcanic mountains, and earthquakes frequently occur. The convulsions which attend them, and the gradual recedes of the sea, produce new land; while its encroachments on other parts occasion beds of sand, and the overflow of the dry earth. The chain of islands that lie parallel with the west coast of Sumatra may probably have been a part of the main, and separated from it, either by some violent effect of nature, or the gradual attraction of the sea. The coast, however, where the shore is flat and shelving, is defended from the attack of the sea by a reef or ledge of coral rock, against which the surf (a term erroneously laid by Mr. Marfiden not to occur in our dictionaries) exerts its violence, without any great effect. (See Surf.) The spring-tides on the west coast of Sumatra are attimated to rise in general no more than four feet; it is always high water there when the moon is in the horizon, and consequently at fix o'clock nearly, or the days of conjunction between the year, in parts not far remote from the equator. This, according to the Newtonian theory, is about three hours later than the uninterrupted course of nature; and is owing to the impediment which the waters meet with in revolving from the eastward.

The inhabitants of Sumatra may generally be divided into three classes: one comprehending the Mahomedan inhabitants of the sea-coast, and the other the Pagan of the inland country; and if we descend to the principal subdivisions, we may distinguish the empire of Menangchow, not Menangchow (which feee), and the Malays; the Aboro; the Battas; the Rejangs; and the Lampoons. The Rejangs, though inconsiderable in the political scale of the island, are placed by Mr. Marfiden in a kind of central situation, not geographically, but with regard to the encroachments of foreign manners and opinions, introduced by the Malays from the north, and the Javans from the south. Their form of government and laws extend, with little variation, over a considerable part of the island, and especially over that portion principally connected with the English. These people, formerly of more extensive diffusion, have a proper language, and a perfect written character, that is generally used in remote districts. The country of the Rejangs is divided, to the north-west, from the kingdom of Anac Boongey, of which Muco Muco is the capital, by the small river Oori, near that of Cattows; which last, with the district of Laboon on its banks, bounds it on the north or inland side. The country of Muoco, where Palembang river rises, forms its limits to the east. Bencoolen river confines it on the south-east; though the inhabitants
inhabitants of the district called Lemba, extending from thence to Silebar, are entirely the same people in manner and language. The principal rivers, besides those already mentioned, are Laye, Pallay, and Soongeylamo; in all which the English have factories, the resident or chief being stationed at Laye. The persons of the inhabitants of the island, though differing considerably in district remote from one another, may be comprehended in general under the following description; except the Achenees, whose complexion with the Moors of the west of India has distinguished them from the other Sumatrans. They are rather below the middle stature; their bulk corresponds; their limbs are for the most part short, but well-shaped, and particularly small at the wrists and ankles. Upon the whole, says Mr. Mariden, they are gracefully formed; and among the natives there is scarcely one deformed person to be seen. The women, however, have the preposhous custom of flattening the noses and compressing the heads of children newly born, which, as the skull is cartilaginous, increases their natural tendency to that shape. A similar practice prevails at Uletsia. They likewise pull out the ears of infants, in order to make them stand erect from the head. Their eyes are uniformly dark and clear; their hair is strong and of a shining black colour, improved in this respect by the constant and early use of cocoa-nut oil. The men wear their hair short, but that of the women is long, reaching in some instances to the ground. The men are bearded, but the Malay priests display a little tuft, which is sufficient to show that nature has not witheld from them this token of manhood. It is the same with respect to other parts of the body, in both sexes; and this mode of attention to their persons is esteemed a point of delicacy, and the contrary an unpardonable neglect. The boys, as they approach puberty, rub their chins, upper lips, and those parts of the body that are subject to superfluous hair, with chunnam (quick-lime), especially of shells, which destroys the roots of the incipient beard. The few pigs that afterwards remain are eaten out with twinges, which they constantly carry with them for this purpose. Their complexion is yellow, and that of the superior clafs, and especially of women of rank, approaching to a great degree of fairness. Most of the females are disgusting ugly, but some of them exhibit an appearance that is strikingly beautiful. Perons of superior rank encourage the growth of their hand-nails, particularly those of the fore and little fingers, to an extraordinary length; occasionally tingling them red, with the expressed juice of a shrub, called eeni, as they do also the nails of the feet, which are always uncovered. The natives of the hills, through the whole island, are subject to those monstrous wens from the throat, of which instances occur in Europe. (See Goitre.) The inhabitants of the country are superior to the Malays of the coast in respect of size and strength, and fairness of complexion. The inhabitants of Pahsummah are also described as being more robust in their features than the planters of the low country.

The original clothing of the Sumatrans is the same with that found among the inhabitants of the South Sea islands, and is mostly, in the habitation cloth. The men consist of a clofe waffcoat, without sleeves, having a neck like a shirt, buttoned close up to the top with buttons, often of gold filagree. This is peculiar to the Malays. Over this they wear the "badjoo," which resembles a morning gown, open at the neck, but fastened close at the wrists and half way up the arm, with nine buttons to each sleeve; usually made of blue or white cotton-cloth; for the better fort of chints, and for great men of flowered fikls. The "cayen-farrong" is not unlike a Scots highlander's plaid, being a piece of parti-coloured cloth, six or eight feet long, and three or four wide, fewed together at the ends, forming, as some have described it, a wide fack without a bottom. This is sometimes gathered up, and flung over the shoulder like a fash, or folded and tucked about the waist and hips; and in full dress, boused on by the belt of the creefe (dagger), which is of crimson silk, and wraps several times round the body, with a loop at the end, in which hangs the sheath of the creefe. They wear short drawers, reaching half way down the thigh, generally of red or yellow taffeta. They have no covering to their legs or feet. Round their heads they fasten a kind of turban, which is a fine coloured handkerchief; the country people usually twifling a piece of white or blue cloth for this purpose. The crown of the head remains uncovered, except on journeys, when they wear a "toodong," or umbrella hat, completely screening them from the weather. The women have a kind of bodice, or rather short waffcoat, that defends the breasts, and reaches to the hips. The cayen-farrong comes up as high as the arm-pits, and extends to the feet, being folded and tucked over at the breast; except when the "talies-pending" or zone, is worn about the waist. This is usually of embroidered cloth, sometimes fastened with a plate of gold or silver, about inches broad, and in front with a clasp of filagree work, with four kinds of precious stones. The women, however, have the "salendang," or piece of fine, blue, thin cotton-cloth, five feet long, and wrought or fringed at each end, is thrown across the back of the neck, and hangs down before, serving as a veil to women of rank, when they walk abroad.

They have different modes of dressing the hair; they wear no covering, except ornaments of flowers, which are fancifully arranged. Among the country people, particularly in the southern mountains, the virgins (orang-guddeo, or goddeefes, as it is usually pronounced) are distinguished by a fillet, which goes across the front of the hair, and fastens behind. This is commonly a thin plate of silver, about an inch broad; those of the first rank have it of gold, and those of the inferior clafs ufe the leaf of the neepah tree. Befides this peculiar ornament, their flate of pucelage is denoted by their having rings or bracelets of silver or gold on their wrists. Strings of coins are universally worn by children, and the females, before they are of an age to be clothed; and they have a kind of modesty-piece, which is a plate of silver in the shape of a heart, hung before by a chain of the same metal, or ringed round the waist. Both sexes have the extraordinary custom of filing and otherwise disfiguring their teeth, which are naturally very white and beautiful. At the age of about eight or nine they bore the ears of the female children, a ceremony which must precede their marriage. Their ear-rings are mostly of gold filagree, fastening, not with a clasp, but in the manner of fluds.

The houfes of the Sumatrans are not only permanent, but convenient, and are built in the vicinity of each other; that they may enjoy the pleasure and benefit of society. Their suburbs, or "downdens," are always fruited by the banks of a river or lake, for the convenience of bathing, and of transporting goods; and an eminence, difficult of access, is generally chosen for security. The rows of houfes commonly form a quadrangle, with passageways or lanes between the buildings, occupied in the more considerable villages, by the lower clafs of inhabitants, and where their padde-houfes or granaries are erected. It is in the middle of the square stands the "balii," or town-hall, which is a room about

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SUMATRA.

50 to 750 feet long, and 20 or 30 wide, without division, and open at the sides, except when on particular occasions it is hung with mats or chintz. In their buildings, they never use stone, brick, or clay; but the frames of their houses are of wood, the under-plate resting on pillars of about six or eight feet in height, which have a sort of capital, but no base, and are wider at top than at bottom. For their flooring, they lay whole bamboo, four or five inches in diameter, close to each other, and fasten them at the ends to the timbers. Across these are laid laths of split bamboo, about an inch wide, and of the length of the room, which are tied down with filaments of the rattan, and over these are usually spread mats of different kinds. The sides of the houses are generally closed with bamboo half-split, or with the bark of some kinds of trees. The most general covering of their houses is the leaf of a species of palm called neepal. The mode of ascent to the houses is by a piece of timber, or stout bamboo cut in notches, their buildings being raised to different elevations, in order to secure themselves from the attacks of wild beasts. In the buildings of the doorways, where the most respectable families reside, the wood-work in front is carved, in the style of bas-relief, into a variety of uncouth ornaments and grotesque figures, not much unlike the Egyptian hieroglyphics, but certainly without any mystic or historical allusion. The furniture of their houses is as simple as the buildings; their bed is a mat, usually of fine texture, and manufactured for the purpose, with a number of pillows worked at the ends, and adorned with a shining substance that resembles foil: over the head hangs a sort of canopy or valance. Instead of tables, they have somewhat that resembles large wooden falters, round each of which three or four persons dipose themselves; and on these are laid large wasters, which hold the cups that contain their curry, and plantain leaves, or moties or leaflets, filled with rice. Their mode of fitting is either on the hamsches, or on the left side, supported by the left hand, with the legs tucked in on the right side; leaving that hand at liberty, which they always, from motives of delicacy, scrupulously eat with: the left being reserved for lefs cleanly offices. They employ neither knives, spoons, nor any substitutes for them; they take up the rice and other victuals between their thumb and fingers, and dexterously throw it into the mouth by the action of the thumb, dipping frequently their hands in water as they eat. In cooking they employ an iron vessel, with a wide rim and narrow bottom; they have some coarse china, and a species of earthen pipkins, used in their cooking, mostly imported from Bantam; and in smaller number in the island, particularly in Lampoon, where they give them a sort of glazing: but the original Sumatran vessel for boiling rice, is the bamboo, which the fire almozt wholly destroys before the rice is drenched. They have occasion for fire, chiefly in cooking their victuals; but their houses have no chimneys, and their fire-places are merely temporary contrivances of a few loose bricks or stones: their fuel is wood: flint and flake for striking fire are unknown, but they are chiefly used in traveling, when they take up their habitations in the woods or deserted houses. They frequently kindle fire by the friction of two sticks; seizing a piece of dry, porous wood, and cutting smooth a spot of it, and they then apply a smaller piece of a harder substance, with a blunt point, in a perpendicular position, the other lying horizontally, and turn it quickly round, between the hands, as chocolate is milled, pressing it downwards at the same time. By this motion a hole is soon formed, and before it has penetrated far, the larger piece takes fire. The food of the Sumatrans is chiefly vegetable; but in their entertainments, they admit the flesh of the buffalo, goat, and fowls. Their dishes are allSOO prepared in that mode of dishing called "curry," but whatever be the quantity or variety of their meat, the principal article of their food is rice. Their meat is drenched immediately after the animal is killed, except when they preserve it in the mode called "drying:" this is done by cutting the flesh of the buffalo into small thin flakes, and exposing them to the heat of the sun, generally on the thatch of their houses, till the meat becomes so dry and hard, as to resist purification, without the use of salt. Fifth is also preferred in the same manner.

The most important article of cultivation in Sumatra is rice, which serves both for the food of the inhabitants and for commerce. The next important object of culture is the cocoanut tree, which is applied to a variety of purposes. To thefe we may add the "penang," or betel-nut tree, of which the natives make large plantations. The island also is richly strewed with vegetables of other kinds for domestic use. Their fruits and flowers, as well as medicinal shrubs and herbs, are too numerous to be recounted in this place. Their beasts, birds, reptiles, and insects, are too various for recital. Of those productions of Sumatra, which are regarded as articles of commerce, the most important and abundant is pepper, of which the natives distinguish three species, which are called in different places by different names. Among other commodities of the island, a conspicuous place belongs to the camphire, to which we might add the benjamin or beouzoin, the cassia, rattans, and canes, cotton, coffee, turpentine, and gums. As varieties of wood, we may enumerate the ebony, pine, fad extends, teak, manchineel, iron-wood, and the banyan-tree. Besides these articles of trade afforded by the vegetable kingdom, Sumatra produces many others, and among the chief of these is gold; it affords also tin, copper, and iron, sulphur, arsenic, and salt. The manufacture of wax, ivory, and birds’-nefs. The general articles of import trade are the following: from the coast of Coromandel, salt; long cloth, blue and white; chintz, and a variety of other cotton goods; from Bengal, opium and taffetas; from China, coarse porcelain, tobacco, iron pans, and a number of small miscellaneous commodities; from the Eastern islands, Buggelias clouting, a coarse, striped, cotton manufacture, much worn; guns, called zantakers, creeses, and other weapons; fillers creese-belts, toodongs or hats, salt of a large grain, and sometimes rice, especially from the island of Bally; from Europe, silver, iron, lead, cutlery, and other hardware, brass-wire, and flaxen cloth. Among the manufactures of Sumatra, we may mention the flax, (which see), the forging, &c. of iron, the carpenter’s work, carving in wood and ivory, cane and basket work, and the manufacture of mats, of silk and cotton cloths, and different kinds of earthenware, of gunpowder, of sugar, and of salt. The skill of the Sumatrans in the sciences is very limited. They are fond of music; but most of their instruments are borrowed from the Chinese. The Malay language is universally spoken along the coast of Sumatra, it is practised in Java and the Moluccas, and it is the mediate dependencies, and is understood almost in every part of the island. This language has been much and justly celebrated for the smoothness and sweetness of its sound, infonch that it has been called the Italian of the East: this is owing to the prevalence of liquids and vowels in the words, and the infrequency of any harsh combination of mute consonants: and these qualities render it peculiarly adapted to poetry, to which the Malays are passionately addicted. The character used by the Malays in writing is the Arabic; their books are, for the most part, either transcripts from the Koran, or legendary tales, of little merit as compositions.
compositions. Besides the Malay, many other languages are spoken in Sumatra, the principal of which are the Rejang and the Batta. Their writings are executed with ink, on the inner bark of a tree, cut into narrow strips of considerable length, or folded together in squares, each square or fold answering for a page. On occasions they write on the outer covering of a joint of bamboo, with the point of their creese or other weapon, which serves the purpose of a stylus. None of these languages are so agreeable as the Malay. The Malay and native Sumatran differ more in the features of their mind than in those of their person. The Malay, it is observed, may be compared to the buffalo and tiger. In his domestic state, he is indolent, stubborn, and volupptuous as the former, and in his adventurous life, he is infectious, blood-thirsty, and rapacious as the latter. The original Sumatran is mild, peaceable, and forbearing; but when his resentment is roused, he is implacable. He is temperate and sober, being equally abstemious in meat and drink. Hospitality is carried to the extreme among the Sumatrans: their manners are simple, generally devoid of the Malay cunning and chicane, and yet quick of apprehension, and endowed with a considerable share of penetration and sagacity. In respect to women, without being inoffensive, they are remarkably continent; they are modest, guarded in their expressions, courteous in their behaviour, grave in their deportment, being afraid not to laugh, and to a great degree patient. On the other hand, they are licentious, indolent, addicted to gaming, diffident in their dealings with strangers, fulsome, regardless of truth, mean in their transgressions, servile, cleanly in their persons but dirty in their apparel, which they never wash: impoverished of the future, as their wants are few, and easily supplied. Of their government, laws, customs, and manners, we can only give a hasty and imperfect sketch. The inhabitants of the Rejang country live in villages or doofoons, under the government of a magistrate, called "dupatty." His dependants seldom exceed 100. A certain number of the dupatties belonging to each river, are chosen to sit in a legislative or judicial capacity, at the quaioc or river's mouth; and over the whole presides the pangaran, or prince of the country. All the governments throughout the island are a mixture of the patriarchal and feudal. The foundation of right to government among these people seems to be the general consent; and if a chief excites an undue authority, they conceive themselves at liberty to relinquish their allegiance. The powers of the pangaran, though he claims delphic sway, are very limited, and he is seldom able to punish a turbulent subject, otherwise than by private assassination. He levies no tax, nor has any revenue. Appeals in all cases lie to him, and none of the inferior courts are competent to pronounce sentence of death. All punishments and cauks are by the laws of the country commutable for fines, and appeals, being expensive, seldom occur. Although the rank of dupatty is not strictly hereditary, the fon generally succeeds the father at his decease.

The Rejangs are distinguished into tribes, the descendants of a different ancestor. Of these tribes there are four principal ones, which are said to derive their origin from four brothers, who have been united from time immemorial in a league, offensive and defensive: there are several inferior tribes. The system of government among the people near the sea-coast, who, towards the southern extreme of the island, are planters of pepper, is much influenced by the Europeans, who are lords paramount. Pafsummah, which nearly borders upon Rejang to the S.W., is an extensive and comparatively populous country, bounded on the N.W. by that of Lassattang, and on the S.E. by that of Lempoo, and distinguished into the broad Pafsummah, which lies inland, and extends within a day's journey of Palembang river; and Pafsummah on the W. side of the range of hills, whether the inhabitants are said to have mostly removed, in order to avoid the government of the Dutch. Pafsummah is governed by four independent pangerans, who acknowledge a kind of sovereignty in the sultan of Palembang; and in almost every doofoon there is an inferior pangeran.

Among the Rejans, there is not any perfous or clafs of persons regularly invested with a legislative power. In all their duties they are governed by traditional customs, the authority of which is founded on usage and general consent. All causes, both civil and criminal, are determined by the several chiefs of the district, assembled together, at stated times, for the purpose of distributing justice. They settle litigations with respect to property by a kind of arbitration. The Rejang laws have not long ago (in 1770) been collected into a code, and committed to writing. The modes of marriage, according to the original institutions of the Sumatrans, are by joojoo, ambel-ana, and femundo: the first is a certain sum of money, given by one man to another, as a consideration for the person of his daughter, whose situation differs little from that of a slave to the man she marries, and his family. Chastity is a prevalent virtue in Sumatra. In the country, prostitution for hire is unknown, and is confined to the Malay bazaars at the sea-ports. Adultery is punishable by fine, but the crime is rare. In the second mode of marriage, by ambohana, the mother of a virgin makes choice of some young man for her husband, generally from an inferior family, and he is taken into the house of his father-in-law, who kills a buffalo on the occasion, and receives 20 dollars from the fon's relations. In this case, the bridegroom becomes wholly, as it were, the property of the family with which he connects himself; all his interests are vested in that family and dependent upon it, and he has in himself so property. The third mode of marriage, called femundo, has been adopted from the Malays. It is a regular sham between the parties, on the footing of equality. The nature of marriage consists simply in joining the hands of the parties, and pronouncing them man and wife, without much ceremony, except the entertainment given on the occasion; and a little apparent courtship precedes marriage. The customs of the Sumatrans permit their having as many wives by joojoo as they can afford to purchase and maintain; but they have seldom more than one. A man married by femundo cannot take a second wife, without repudiating the first.

Among the amusements of the Sumatrans, gaming is very prevalent: accordingly they gamble with dice. They adduce themselves to cock-fighting, and to quail-fighting. Fencing is a common diversion; so is the diversion of toffing a ball. Smoking of opium is a common practice, and the use of it is general and pernicious. (See Amook.) Betel and tobacco are also much used. The Sumatran females bear children at an early age, wise, before 15, and they are generally past it at 30, and grey-headed and thinned, at 40. The country people being totally ignorant of chronology, can seldom give an account of their age. The children among the Rejangs have generally a name given them by their parents, soon after their birth; and another name, sometimes title, is bestowed at a subsequent, but not determinate period. The father is sometimes named from his first child; the women never change the name given them at their birth. A Sumatran frantically abstains from pronouncing his own name. The boys are circumcised, where Mahometanism prevails, between the sixth and tenth year. At their funerals,
funerals, the corpse is carried to the place of interment on a
broad plank, which is kept for the public service of the
doorsom, and lasts for many generations; it is constantly
rubbed with lime, either to preserve it from decay, or
to keep it pure. No coffin is used, the body being simply
wrapped in white cloth: round the grave are fixed white
flags or „reamers; a shrub, bearing a white flower, and
sometimes wild marjoram. The women who attend the
funeral make a hideous howl, like the Iri. Burying
places are held in extraordinary reverence.

The Rejangs are said to be totally without religion, nor
can they be denominated Pagans, if that appellation con-
veys the idea of mistaken worship. They worship neither
God, devil, nor idol. Nevertheless, they have some con-
fused notion of superior beings, who may render themselves
visible or invisible at pleasure; but they have no name for
the Deity. The superstition that has the greatest influence
on the minds of the Sumatrans, and which approaches
nearest to a species of religion, is that which leads them to
venerate, almost to adoration, the toms and manes of their
deceased ancestors. The Sumatrans have an imperfect
notion of a metempsychosia; and in some parts, chiefly
southeastward, they superstitiously believe that certain trees,
particularly those like the banyan, of venerable appearance,
are the parts of the mortal frame of spirits of the woods, a
notion resembling that of the dryadse and hamadryades
among the ancients. The inland people are paid to pay a
kind of adoration to the sea, and to make it an offering
of cakes and sweetmeats on their first beholding it, deprecating
its power of doing them mischief.

The account which we have already given of the manners
and customs of the Rejangs may serve in general for the inhabi-
tants of other districts of Sumatra: but where any very
remarkable dissimilitude occurs, it will be found noticed in the
sequel of this, or in the general account of the Lampoon country, as
Lampon; of the Malay government and Menangcbow; see Malaoca
and Menangcbow. The country of the Rejangs may be con-
sidered in general as bounded to the N. by that of Aceh, and
to the S. by Paffamman and the independent district of
Ou or Aru; or more precisely, as extending from the great
river of Sinkell to that of Taboocoy, on the coast, and
inland, as far S. as Ayer Bongey, at the back of which the
Ou people commence. The country is populous, and the
majority of the people reside at a distance from the sea, in the
central parts of the interior plains; but more than one
ridge of hills, on the borders of a great lake; where the
soil is fertile and much cultivated. This country is divided
into a number of districts, of which the principal are as fol-
low: viz. Ancola, Padambola, Mendeeding, Toba, Selendo-
gang, and Sinkell. The inhabitants are subdivided into
tribes, of which Ancola has five, Mendeeding three, and
Toba five; the others are not ascertained. The English
settlements in this part of the island are at Natal and Tappa-
nooey. See NATAI and TAPPANOOLY.

The province of the Rejangs is rich in precious stones of
camphire, gum ben-
jamin, cafias, cotton, and indigo. The domestic animals are
horses, cows, buffaloes, goats, hogs, and dogs of the cur
kind; with the wild ones that are common to all parts of
Sumatra.

The Battas are in their persons below the stature of the
Malays, and their complexions are fair. Their dress is
commonly of a species of cotton-cloth, which they them-
selves manufacture; this they adorn with fringes of beads;
and the covering of the head is usually the bark of a tree. The
young women wear rings of tin in their ears, often to
the number of fifty in each. The food of the lower people

is maize and sweet potatoes: the rajals and persons of in-
ferior rank indulge themselves with rice; and on public
occasions they kill cattle for food. Their horses they clothe
the most luxurious food. Their houses are constructed
with frames of wood, and boarded; and their roofs are covered
with a species of vegetable, that resembles coarse horsecab.
Their towns seldom consist of more than twenty houses;
and in each of these is a kind of town-hall, for the transacti-
of public business, festivities, and the reception of strangers,
whom they entertain freely and hospitably. At the end of
this is a building, from which are seen the spectacles of leas-
ing and dancing, and below it is a kind of orchestra for
music. The men are allowed to marry as many wives as a
civil place, each of whom has her own apartment; the parents of the younger woman receive a valuable consideration
from the husband, and this is returned when a divorce
takes place against the man's inclination. The condition
of the women appears little better than that of slaves:
besides their domestic duties, they work in the rice planta-
tions, whilst the men lead an idle inactive life, passing the
day in playing on a kind of flute, crowned with garlands of
flowers. Their music is preferable to that of the other Se-
matrans. They are much addicted to gaming, which they
pursue to such an excess, that when a portion loses more than
he can pay, he is compelled the Mapilias and Malabar one.
Horse-racing is a favourite diversion. The Battas have a language and
written character peculiar to themselves.

Dr. Leyden (see Asiatic Researches, vol. 1) confers
the Batta language as the most ancient language of Suma-
tra, and as having considerable claims to originality; though it
is not only connected with that of the Malays, but also with
the Bugis and Bima languages. In point of constructi
it is equally simple as the Malay, but its most intimate
connection is with the Bugis, which may be reckoned in
the original language of the Ifam has her two letters, ap,
with twenty-two letters, varied by the six vocalic fonds,
a, e, i, o, u, u. The Batta language is said to be the chief
source of that diversity of dialect which is discoverable in
the languages of Sumatra. The Rejang dialect is formed by
the mixture of the Batta and Malay; of the Lampung or
Lampon, by mixing Malay and Batta with a proportion of
the Javanese. The Karrwos, who are subject to Ach or Achi,
use only a slight variation of the Batta language, while in
the language of Ach or Achi proper consists of a mixture of Malay and
Batta, with all the jargons used by the Moçems of the East.
The Achines are divided into a number of tribes, each of which is
able to fix vocalic founding, like the Buggis. The Batta cha-
acter is written neither from right to left, nor from left
to right, nor from top to bottom; but in a manner directly
opposite to that of the Chinefes, from the bottom to the top
of the line, as the Mexicans are said to have arranged their
hieroglyphics. The material for writing is a bamboo, or
the branch of a tree, and the instrument with which they work
is the point of a kris or creafe. The Battas sometimes use
their bamboo horizontally instead of perpendicularly, as in
the Chinefes and Japanese do their books, but the Chinefes
consider the correct mode of reading to be from the top to the
bottom.
SUMBAWA, SUMBAVA, or Sumbawa, one of the Celebesian islands, opposite to Bouton (which lies), consists of several petty states, viz. Bima, Dompo, Tambora, Sangar, Papakat, and Sumbawa, independent of each other, but united together by a defensive alliance, as far as regards their possessions in this island. Bima lies at the east end of Sumbawa, about 45 leagues S. of the W. point of Celebes; it is in the same flat, under whose jurisdiction are comprehended the islands of Sasa, the whole of Mangery at the W. point of the island of Endé, childishly demoted to the early Portuguese navigators, and also by succeeding voyagers and geographers, and the island Goenong-api, which last lies a little to the N. of Bima. The Bima language, which is used in the independent states of Bima, extends also over the greater part of the island Endé. It is in some respects related to Bugis and Javanese, and on the coast is mixed with Malay; nevertheless it has strong pretensions to originality in its pronouns, verbal auxiliaries, and simple names of objects. The dialect of Bima is of Obi, and all the inhabitants of the islands are called Obi, almost always pronounced Bali. Hence it is not improbable that Herodotus refers to the ancient Batta.

The government of the country is divided into a number of chiefships, the heads of which, called rajahs, are seldom dependent upon any superior power; but they enter into associations with each other, particularly those of the same tribe, for mutual defence and security against any common enemy. The more powerful rajahs assume authority over the lives of their subjects. The revenues of the chief arise principally from fiefs, paid to them in justice; and while their fiefs are settled by a magistrate, appointed for that purpose; and from him there is no appeal to the rajah. Notwithstanding the independent spirit of the Batta, they pay great respect to the sultan of Menangcob. With regard to war, they are in a state of perpetual hostility, and they are always prepared for attack and defence. Their campan of towns are fortified with large ramparts of earth, half-way up which they plant brushwood; and without the rampart there is a ditch, on each side of which is a palisade of carrion timber, and beyond this a hedge of prickly bamboo. At each corner of the fortress, instead of a tower or watch-houses, they contrive to have a tall tree, which they ascend to reconnoitre, and from which they fire. The standard in war is a horse's head, from which hangs a long mane or tail of hair. Their arms are matchlock guns, bamboo lances, and a fide-weapon, like a sword or large knife. They carry no creese, like the Malays. They have machines, curiously carved, for holding their bullets, and others for the reserve of gunpowder, which they manufacture for themselves. In trade, the natives of the island exchange their camphire and camphire for iron, steel, brass-wire, and salt. They barter again with the more inland inhabitants, for the products and manufactures of the country.
SUM

SUMEN, a word used by some anatomical writers to express the hypogastrium.

SUMENE, in Geography, a town of France, in the department of the Gard; 4 miles E. of Le Vigan.

SUMI, a town of Russia, in the government of Charkov; 68 miles N.N.W. of Charkov. N. lat. 50° 54'. E. long. 35° 4'.

SUMIDOIRO, a river of Brazil, in the capitania of Matto Groppo, which runs for some distance under ground, and thence derives its name. It empties itself on the S. side into the Amazon; and as its source is at a short distance from that of the Guayouba, a large western branch of the Paraguay, there is an easy communication from the one to the other.

SUMISSOR, a town of Napaal; 70 miles from Moscow.

SUMISWALD, a town of Switzerland, in the canton of Berne; 12 miles W. of Berne.

SUMITRA, in Hindoo Mythology, was the mother of Lakhshman, half-brother to the heroic Ramachandra; Dahartha being the mortal father of both. Both, however, are stated to be in fact of divine origin, Rama being an incarnation of Vishnu, and Lakshman of Siva, the mighty many-headed serpent, on which Vishnu reposeth, in his paradise called Vaikuntha.

SUMMAH, in Geography, a town of Algiers; 12 miles S.S.E. of Constanina.

SUMMARO, a small island in the Baltic, S.E. of Aland. N. lat. 50° 58'. E. long. 20° 5'.

SUMMARY, an abridgment, containing the sum and substance of a thing in a few words.

The summary, placed at the head of a book, a chapter, a law, or the like, is very useful to the reader, to facilitate the understanding of them.

A recapitulation is to contain a summary of the whole preceding discourse.

SUMMARY Conviction, in Law. See Conviction.

SUMMATORIUS CALCULUS, the method of summing differential quantities; that is, from any differential given, to find the quantity, from whole differencing the given differential results.

This method we more usually call the **inversion method** of **summation**; and foreigners, **integrals calculus**. See **CALCULUS and FRACTION**.

SUMMEI-KIEUM, in Geography, a town of the Birman empire, on the Irrawaddy, in which is a manufacture of saltpetre and of gunpowder; 60 miles S.S.W. of Ava.

SUMMEIMTOH, a town of Birmah, on the Irrawaddy; 6 miles N. of Deneebow.

SUMMER, a small river of Brabant, which runs into the Deme near Hasselt.

SUMMER, one of the seasons of the year, commencing in these northern regions, on the day the sun enters Cancer, and ending when he quits Virgo.

Or, more literally and universally, the summer begins on the day when the sun's meridian distance from the zenith is the least. It ends on the day when his distance is a mean between the greatest and smallest.

The end of summer coincides with the beginning of winter.

It is said, that a frosty winter produces a dry summer; and a mild winter a wet summer. It often happens so, in fact; but why it should be so, is perhaps a question difficult to determine. The curious may, on this subject, consult the Philosophical Transactions, No. 458, sect. 10.

SUMMER-CLAIR, in Rural Economy, a provincial term applied to the undulating state of the air seen in a hot, calm day near the surface of the ground, appearing to rise as from hot embers, in which case it is said the **summer-clair** rides.

SUMMER-Crepuscul, in Botany. See CHERNOPHYTUM.

SUMMER-Edén, in Agriculture, a provincial word signifying to make use of as a pasture at that season, or to summer-feed.

SUMMER Frost-Marking, for Shepherds, in Rural Economy, the practice of milking ewes for the purpose of converting their milk into cheese. This custom or practice was some time ago much on the decline, in consequence of the injury done to the sheep, but has more lately been somewhat revived, on account of the increasing demand and value of the cheese thus produced.

The summer ewe-milking for this use, formerly commenced, is said by the writer of the Agricultural Report of the County of Peebles, 'there about the latter end of June, the lambs being weaned early, is the order that the more cheese might be made: it now, however, seldom takes place until the beginning or middle of the following month; continuing in some places for nine weeks, but more commonly confined to about six. The sheep-farmer not unfrequently needs additional female-servants for performing the buffeting of ewe-milking.'

A ewe is a female serving, or ewer. Seven or more of these are often allotted to each milker: consequently but little time can be allowed for sleep during the night, especially as the ewes must be milked over night, when confined to the fold, and again in the morning, before putting them out to pasture: besides, the time of detaining them in the fold is shortened as much as possible, that they may have more time to feed through the day.

The fold for milking the ewes is a sort of inclosure of the fold-like kind, with walls inserted below the coping-folds, in order to prevent the ewes from breaking or leaping over it; and value of the cheese, thus produced. The summer ewe-milking for this use is but little time can be allowed for sleep during the night, especially as the ewes must be milked over night, when confined to the fold, and again in the morning, before putting them out to pasture: besides, the time of detaining them in the fold is shortened as much as possible, that they may have more time to feed through the day. The fold for milking the ewes is a sort of inclosure of the fold-like kind, with walls inserted below the coping-folds, in order to prevent the ewes from breaking or leaping over it; and value of the cheese, thus produced. The summer ewe-milking for this use is but little time can be allowed for sleep during the night, especially as the ewes must be milked over night, when confined to the fold, and again in the morning, before putting them out to pasture: besides, the time of detaining them in the fold is shortened as much as possible, that they may have more time to feed through the day. The fold for milking the ewes is a sort of inclosure of the fold-like kind, with walls inserted below the coping-folds, in order to prevent the ewes from breaking or leaping over it; and value of the cheese, thus produced. The summer ewe-milking for this use is but little time can be allowed for sleep during the night, especially as the ewes must be milked over night, when confined to the fold, and again in the morning, before putting them out to pasture: besides, the time of detaining them in the fold is shortened as much as possible, that they may have more time to feed through the day.
high price, on account of its scarcity; but which may be remedied, it is thought, as the cost of it becomes so high as to render it beneficial for the sheep-farmer to sacrifice the advantage of the animals to the increase of their cheese.

The cheese, when become old, is, it is said, accounted one of the best stomachics that can be used as food. It is said of late to have fetched an enormous price, which is recalling the practice of ewe-milking and making of cheese.

The wages of ewe-milking unusually amount, it is said, to above half-a-crown a week, with board; each milker being allowed, besides, a piece of coarse cloth, which is called an ewe-milkers' brat, in order to cover her before, and prevent her clothes from being spoiled by the tar and other filth adhering to the wool of the sheep.

SUMMER-FALLOW, in Agriculture, a name sometimes given to a naked fallow. See FALLOWING OF LAND.

SUMMER-FALLOWING, a term often applied to the process or practice of frequently ploughing and working over arable land at this season, with the view of ameliorating and rendering it clear of weeds. It is chiefly had recourse to for crops of the wheat kinds, but sometimes for those of the barley, turnip, and some other sorts, which require a fine mouldy clean state of the more superficial parts of the soil. The author of a late work on "Agricultural Chemistry," has supposed that the chemical theory of summer-fallowing is very simple. It affords, it is said, no new source of riches to the soil or land; it merely tends to produce an accumulation of decaying matter, which, in the common course of crops, would be employed as it is formed; and that it is scarcely possible to imagine a single instance of a cultivated soil, which can be supposed to remain in summer-fallow for a year with advantage to the farmer. The only cases where this practice can be beneficial, it is said, seem to be those in which it may be used for the destruction of weeds, and for cleaning such soils as are in a foul condition.

In this ancient practice, which is still extensively made use of, the soil or surface mouldy earth is much exposed to the air, and submitted to different procedures, which are purely of a mechanical nature. It is thought that the benefits arising from fallows, or fallowing, have been much overstated; that a summer-fallow, fallowing, or a clean fallow, may sometimes be necessary on lands overgrown with weeds, especially if they be fends which cannot be pared and burnt with advantage; but that it is certainly unprofitable as a part of a general system in husbandry or management of land.

It has been supposed, it is said, by some writers, that certain principles necessary to fertility are derived from the atmosphere, which are exhausted by a succession of crops; and that these are again supplied during the repose of the land, and the exposure of the pulverized or broken-down parts of the soil to the influence of the air; but that this, in truth, is not the case. The earths commonly found in soils cannot, it is said, be combined with more oxygen; some of them unite with azote; and such of them as are capable of attracting carbonic acid, are always saturated with it in those soils on which the practice of summer-fallowing is employed.

The vague ancient opinion of the use of nitre, and of nitrous salts in vegetation, seems, it is said, to have been one of the principal speculative reasons for the defence of summer-fallow, or fallowing. Nitrous salts are produced, it is said, during the exposure of soils containing vegetable and animal remains, and in the greatest abundance in hot weather; but that it is probably by the combination of azote from these remains with oxygen in the atmosphere, that the acid is formed; and at the expense of an element which otherwise would have formed ammonia; the compounds of which are evidently much more efficacious than the nitrous compounds in afflicting vegetation.

It is further noticed on the subject, that when weeds are buried in the soil, by their gradual decomposition, they furnish a certain quantity of soluble matter; but that it may be doubted whether there is as much useful manure in the land at the end of a clean fallow, or fallowing, as at the time the vegetables clothing the surface were first ploughed in. Carbonic acid gas is formed during the whole time by the action of the vegetable matter upon the oxygen of the air, and the greater part of it is lost to the soil in which it was formed, being dissipated in the atmosphere.

The action of the sun, too, upon the surface of the soil or land, tends, it is said, to dilate the gaseous and the volatile fluid matters that it contains; and heat increases the rapidity of fermentation; and in the summer-fallow or fallowing, nourishment is rapidly produced, at a time when no vegetables are present capable of absorbing or drinking it up, by which much wants is the consequence.

It is justly concluded that land, when it is not employed in preparing food for animals, should be applied to the purpose of the preparation of manure for plants; which is effected by means of green crops, in consequence of the absorption of carbonaceous matter in the carbonic acid of the atmosphere. But that in a farmer's fallow or fallowing, a period is constantly lost, in which vegetables may be raised, either as food for animals, or as nourishment for the next crop; and that the texture of the soil or land is not so much improved by its exposure then as in the winter season, when the expansive powers of frost and ice, the gradual diffusion of snows, and the alternations from wet to dry, tend to pulverize and reduce it, and to blend its different parts together more fully.

From these facts and circumstances, it is clearly evident that the practice of summer-fallowing should be had recourse to as little as possible by the farmer, as there is obviously much wants and loss by it in other ways than by the length of time the land lies idle and unproductive.

SUMMER Flowers. See Flowers.

SUMMER Fruits. See Fruits.

SUMMER Land, in Agriculture, a term signifying the fallowing of land in the summer.

SUMMER Management of Flowers, in Gardening, is that which confits in the proper cleaning, watering, directing their growth, and exhibiting them when necessary. See SUMMER Stage.

SUMMER Polities. See SOLASTIC.

SUMMER Stage for Flowers, in Gardening, that which is constructed for the purpose of exhibiting different sorts of flowers at this season. These stages, for the auricula and other similar plants in pots, should be built with deal, or some other light wood not liable to warp by the heat of the sun; the back parts of them may, and the sides should always be fo formed as to have a sort of flutters for sliding up and down occasionally, in order to admit air and light when necessary. Light frames should also be made and raised in the fronts and other parts of the stages, for training canvas, sheets, or mats over, for defending and protecting the flowers from cold winds, flight night-sheets, and too great funny heats, which not unfrequently happen, to some kinds, before as well as when they are in full bloom. The shelves on which the flowers are to be placed in the pots or otherwise, should be made something in the manner of flairs, about six inches in width, and raised two or three inches, or more, one above the other. The roof or covering part may be
be formed of light wood, of the fame kinds as above, being made rather lofty in the front, as from about seven to eleven and a half feet, or rather higher, if thought proper. It should be close, rather thick, and durable, in order to prevent the heat of the sun from penetrating too much through it, which would draw up the flower-frames of the plants too much, and render them weak, as well as be injurious to the wood. The lowest shelf, in such frames, should be about three feet from the ground, and the whole confit of not more than fix in number, in order that the flowers may be within easy reach. The whole length of such frames in the front may be different according to circumstances, but about nine feet in the clear is an useful length; in which case, each shelf may contain about fifteen pots of the largest plants; and a frame, when completely full, holds from about eighty to ninety such pots of flowers, which are mostly sufficient. Such show-frames have, in some instances, looking-glasses fixed up in them at one end, so as to give a reflection of the flower-plants, which has often a fine effect. The insides, as well as the outsides of such frame-frames, should be painted with some dark suitable colour, in the former to serve as a back-ground to the flowers; those of the dark-green, black, or chocolate kind, as giving the best contrast, are probably the most proper, by rendering their appearance the most lively and beautiful.

The proper aspects for such frames, are such as best suit the particular sorts of flowers. For the auricula, they may often front a full northern exposure with advantage. See AURICULA.

SUMMER-First, and SUMMER-Working, in Agriculture, terms applied to summer-fallowing.

SUMMER Tatt. See TAT.

SUMMER Tatt, in Ornithology, the name of a bird, the smallest of all the duck-kind, called by Gmelin the annas circus. See also under DUCK, and Tatt.

SUMMER WHEAT, in Agriculture, the triticum e全民um of botanical writers. See SPRING WHEAT.

SUMMER, formed from the French soumet, which signifies the same thing, in Architecture, is a large stone, the first that is laid over columns and piazzas, beginning to make a cross vault; or it is a stone, which being laid over a pedistool, or column, is hollowed to receive the first haunch of a plinth.

SUMMER, in Carpentry, is a large piece of timber, which, being fastened on to two stone piers, or posts, serves as a lintel to a door, window, &c.

There are also summers used in various engines, &c. serving to sustain the weight, &c.

SUMMER-TREE, denotes a beam into which the ends of joists are fastened, and to which the girders are framed.

See BREST-SUMMER, and GIRDER.

SUMMER of an Organ. See SOUND-BOARD.

SUMMERS ISLANDS, in Geography. See BERMUDA.

SUMMILY, in Agriculture, a term popularly signifying a tump fallow, autumn or naked fallow.

SUMMIT, formed from the French sommet, which signifies the same, the vertex or point of any body or figure; as of a triangle, a pyramid, a pediment, &c.

SUMMIT LEVEL, the highest pound of a canal.

SUMMITS OF FLOWERS, the same with the anthers, or tops of the stamens. See FLOWER.

SUMMONER, SUMMONITOR, an appraiser, or petty officer, who is to cite persons to appear at a certain time and place, to answer to the charges exhibited against them. See APPRAISER, and SUMMONS.

SUMMONS, SUMMONITIO, in Law, a citing or calling a person to any court, to answer a complaint, or even to give in his evidence. This is the same with the vocatio in jus, or the cientis, of the civilians; hence also our old word somner, or sumner.

SUMMONS in terra petita, is that made on the land which the party, at whose suit the summons is sent out, seeks to have. This warning on the land is given, in real actions, by erecting a white fitch, or wand, on the defendant's grounds (which fitch, or wand, among the northern nations, is called the baculus nuntiatorio); and by flat. 51 Eliz. c. 3, it must also be proclaimed on some Sunday before the door of the parish church.

SUMMONS ad Warranuntandum is a process, by which the vouches in a common recovery is called.

SUMMONS to Parliament. See PARLIAMENT.

SUMMONS, in War. To summon a place, is to feed a drum, or trumpet, to command the governor to surrender; or, in case of refusal, to protest to make an assault, and to lay all in fire and blood. See CAPITULATION, and CHAMADE.

SUMMULGUR, in Geography, a town of Bengal; 8 miles E.N.E. of Burdwan. N. lat. 23° 31'. E. long. 88° 20'.

SUMMUM BONUM, in Ethics. See Chief Good.

SUMMUM GENUS. See GENUS.

SUMNAUT, in Geography. See PUTTAN-SUMNAUT.

SUMNER, a town of America, in the district of Maine, and county of Oxford, containing 611 inhabitants.

SUMNER, a county of West Tennessee, bounded N. by Kentucky, E. and S. by the Indian lands, and W. by Davidson county, watered by Cumberland river, and very fertile. It contains 13,792 inhabitants, of whom 773 are slaves. This county has a Presbyterian, Baptist, and two Methodist churches.

SUMNUM, a rich district of Persia, in the province of Khorasan, bounded on the N. by mount Elberus, and S. by the Great Salt Desert. It contains 50 villages; and Sumnum, the capital, is a small town, 23 furlongs from Tehran. "Damgan," 12 furlongs from Sumnum, is supposed to be the ancient Hecatompolis, for some time the metropolis of the Parthian empire. This is the chief town of a district of the same name, situated in a spacious plain, famous for a victory gained by Nadir Shah over the Afghans. "The town of "Bifran," called also Shaver, yields, with its dependencies, a revenue of 19,695 tomans.

SUMOOKGUR, a port of Bengal; 11 miles N. of Calcutta.

SUMOOM, HAM, in Meteorology, a perilous wind of Persia. See Great Sandy Desert.

SUMOROKOF, ALEXANDER, in Biography, the founder of the Ruffian theatre, was the son of Peter Sumoroko, a Ruffian nobleman, and born at Molcow in the year 1777. From his father's house, where he acquired the elements of literature, he was removed to the seminary of cadets at Peterburgh, where he displayed a peculiar genius for poetry, as well as great zeal in the profecution of literary improvement. The early productions of his muse were of the amorous clafs; they soon attracted notice; and under the patronage of count Ivan Shuvelof, he was introduced to the empress Elizabeth, and taken under her special protection. Having much admired the books of Racine, he was led to turn his attention to the drama; and at the age of 29 he composed his first tragedy, intituled "Koval." This was exhibited at the court-theatre, and the applause it obtained induced the writer to proceed in the same career, and to have produced nine tragedies, several comedies, and some operas. In his tragedies, Racine was his model; and though
though he fell short of the perfections of his exemplar, he was in many instances a successful imitator of his excellencies. His comedies possessed humour, but were deficient in purity. Sumorokoff, having so far succeeded in his dramatic performances, made attempts in every species of poetry, except the epic. He wrote love songs, idylls, fables, satires, anacreontics, elegies, versions of the Psalms, and Pindaric odes. In the latter species of composition he was far inferior to his contemporary Lomonosoff, being deficient in that elevation and fire which characterize those of the latter; but the tenderness of his elegies, and the natural simplicity of his pastorals, are much admired, and his fables will bear a comparison with those of La Fontaine. Our poet also wrote some historical pieces in prose, which are commended for periclisey of style, though they abound too much in ornament. Sumorokoff enforced the favour of his female sovereigns. Elizabeth raised him to the rank of brigadier, appointed him director of the Russian theatre, and settled upon him a pension of 400l. per annum. Catherine II. created him counsellor of state, honoured him with the order of St. Anne, and distinguished him by her munificence. He died at Moscow in October, 1777, in the 51st year of his age. "In his private character," says one of his biographers, "he exhibited the virtues and the faults of exquisit felicity; equally alive to benefits and injuries, open and unostentuous; polite when treated with respect, but opposing pride by haughtiness; irascible and inconsiderate." With Lomonosoff he contributed to diffuse a taste for poetry and elegant literature among his countrymen, and they have produced a numerous class of followers. Coxe's Travels in Russia.

SUMP, in Metallurgy, a round pit of stone, lined with clay within, for receiving the metal on its first fusion from the ore.

SUM, in Mines, denotes a pit sunk down in the bottom of the mine, to cut or prove the lode still deeper than before; and when the lowest level of that lode is arrived at, it is called a sump. From this pit they lay a pipe, through which, when the sea is in, the water runs into a well adjoining to the sump, and from this well they pump it into troughs, through which it is carried to their cisterns, in order to be ready to supply the pans. See SALt.

SUMPH, in Mining, denotes a pit sunk down in the bottom of the mine, to cut or prove the lode still deeper than before; and when the lowest level of that lode is arrived at, it is called a sump. From this pit they lay a pipe, through which, when the sea is in, the water runs into a well adjoining to the sump, and from this well they pump it into troughs, through which it is carried to their cisterns, in order to be ready to supply the pans. See SALT.

SUMPTER, or SUMTER, in Geography, a district of South Carolina, containing 19,054 inhabitants, of whom 11,638 are slaves.

SUMPTER-HORSE, is a horse that carries provisions and necessaries for a journey, Ruft.

SUMPTERSVILLE, in Geography, a town of South Carolina, in Clermont county; 519 miles from Washington.

SUMPTUARY LAWS, Leges Sumptuarie, are laws made to restrain excess in apparel, costly furniture, eating, 

Most ages and nations have had their sumptuary laws; and some retain them still. But it is observed, that no laws are worse executed than sumptuary laws.

Political writers have been much divided in opinion with respect to the utility of these laws to a state. Baron Montesquieu observes, that luxury is extremely proper for monarchies, and that under this kind of government there should be no sumptuary laws; and it is also necessary in despotic states; but ruinous to democracies. With regard to England, whose government is compounded of both species, it may fill be a dubious question, says judge Blackstone, how far private luxury is a public evil; and as such cognizable by public laws. See LUXURY.

A government, says Montesquieu, may make sumptuary laws with a view to frugality; and this is the spirit of such laws in republics. In general, the purer a state is, the more it is ruined by its relative luxury, and consequently the greater occasion has it for relative sumptuary laws. The richer a state is, the more it thrives by its relative luxury; for which reason it must take care not to make any relative sumptuary laws.

Sumptuary laws may, under some governments, be necessary for particular reasons. The people, says the same writer, by the influence of the climate, may grow to numbers, and the means of subsistence may be so uncertain, as to render an universal application to agriculture extremely necessary. As luxury in those countries is dangerous, their sumptuary laws should be very severe. In order, therefore, to be able to judge whether luxury ought to be encouraged or proscribed, we should examine first what relations there is between the number of people and the facility they have of procuring subsistence. In England the soil produces more than is necessary for the maintenance of those who cultivate the land, and of those who are employed in the woollen manufactures. This country may be therefore allowed to have some trifling arts, and consequently luxury. In France likewise there is corn enough for the support of the husbandman, and of the manufacturer. Besides, a foreign trade may bring in so many necessaries in return for toys, that there is no danger to be apprehended from luxury.

On the contrary, in China the women are so prolific, and the human species multiplies so fast, that the lands, though ever so much cultivated, are scarcely sufficient to support the inhabitants. Here therefore luxury is pernicious, and the spirit of industry and economy is as requisite, as in any republic. They are obliged to pursue the necessary arts, and to shun those of luxury and pleasure.

The sumptuary laws of that ancient Locrian legislator Zaleucus, are famous: by thee it was ordained, that no woman should go attended with more than one maid in the street, except the were drunk: that the should not go out of the city in the night, unless the went to commit fornication; that the should not wear any gold or precious apparel, unless the proposed to be a common harpum: and that men should not wear rings, or tiptoes, except when they went a whoring, 

The English have had their share of sumptuary laws, chiefly made in the reigns of Edw. III. Edw. IV. and Hen. VIII. against picked shoes, short doublets, and long coats; though all repealed by statute 1 Jac. I. c. 85. As to excess in diet, there remains still one law unrepealed. Ste Diet.

Under king Henry IV. Camden tells us, pride was got so much into the foot, that it was proclaimed that no man should wear shoes above six inches broad at the toes. And their other garments were so short, that it was enacted, 25 Edw. IV. that no person, under the condition of a lord, should, from that time, wear any mantle or gown, unless of such length, that, standing upright, it might cover his privy members and buttock.

Among the Romans, the sumptuary and cibary laws were very numerous: by the lex Orcha, the number of guests at feasts was limited, though without limitation of the charges of them. By the Fannian law, made twenty-two years afterwards,
SUN

wards, it was enacted, that more than ten ares should not be spent at any ordinary feast; for the solemn feasts, as the Saturnalia, &c. an hundred ares were allowed; ten of which, Gellius informs us, was the price of a sheep, and a hundred, of an ox.

By the Didian law, which was preferred eighteen years after, it was decreed that the former sumptuary laws should be of force, not only in Rome, but throughout all Italy; and that, for every transgression, not only the master of the feast, but all the guests too, should be liable to the penalty.

SUMRAH, in Geography, a town of Syria, in the pachalic of Tripoli, anciently called Simypha, or Taximra; 18 miles N. of Tripoli.

SUMSERAH, a town of Bengal; 53 miles S. of Dacca.

SUMSERNAGUR, a town of Hindooistan, in Bahar; 52 miles S.W. of Patna.

SUMSKOI, a town of Ruffia, in the government of Oolnitz; 16 miles S. of Kemi.

SUMULPOUR, a town of Hindooistan, in Orissa; 18 miles S.W. of Cuttack.

SUN, SOL, in Astronomy, the great luminary which enlightens the world, and by his presence constitutes day. For his real apparent diameter, density, and distance, see those articles. See also PLANET and SOLAR SYSTEM.

The sun, which, in the infancy of astronomy, was reckoned among the planets, should rather be numbered among the fixed stars. It appears bright and large in comparison with them, because we keep constantly near the sun, whereas we are at an immense distance from the stars. For a spectator, placed as near to any star as we are to the sun, would see that star a body as large and bright as the sun appears to us; and a spectator, as far distant from the sun as we are from the stars, would see the sun as small as we see a star, diversified of all its circulating planets; and would reckon it one of the stars in numbering them.

The sun agrees with the fixed stars in the property of emitting light continually, and in retaining constantly its relative situation, with very little variation; and it has probably many properties in common with them. The stars, as well as the sun, possess gravitation, and the other general properties of matter; they are supposed, like the sun, to emit heat as well as light; and it has been conjectured with great reason, that they serve to cherish the inhabitants of a multitude of planetary bodies revolving round them. See STAR.

According to the Copernican hypothesis, which is now generally received, and which has even demonstration on its side, the sun is the centre of the whole planetary and cometary system; round which all the planets and comets, and our earth among the rest, revolve, in different periods, and in elliptical orbits, according to their different distances from the sun, which is supposed to be placed in the lower focus of all the planetary orbits. Strictly speaking, however, if we consider the focus of Mercury’s orbit to be in the Sun’s centre, the focus of Venus’s orbit will be in the common centre of gravity of the Sun and Mercury; the focus of the Earth’s orbit in the common centre of gravity of the Sun, Mercury, and Venus; the focus of the orbit of Mars in the common centre of gravity of the Sun, Mercury, Venus, and the Earth; and so of the rest. Nevertheless, the focules of the orbits of all the planets, except those of Saturn and the Georgium Sidus, will not be sensibly removed from the centre of the sun; nor will the foculi of these orbits recede sensibly from the common centre of gravity of the Sun and Jupiter. See this motion illustrated and demonstrated under EARTH and PLANET.

SUN, Motion of the. The sun, though thus placed of that prodigious motion, by which the ancients imagined him to revolve daily round our earth, yet is not a perfectly quiescent body.

From the phenomena of his maculae or spots, it evidently appears, that he has a rotation round his axis; like that of the earth, by which the natural day is measured; only slower.

Some of these spots have made their first appearance near the edge or margin of the sun, and have been seen some time after on the opposite edge; whence, after a stay of about fourteen days, they have reappeared in their first place, and taken the same course over again; finishing their entire circuit in 27$^2$ 20th: which is hence deduced to be the period of the sun’s rotation round his axis; and, therefore, the periodical time of the sun’s revolution to a fixed star is 25$^2$ 15th 10th; because in 27$^2$ 20th of the month of May, when the observations on which this calculation is founded were made, the earth describes, according to the elder Calini, an angle about the sun’s centre of 26° 22'; and, therefore, as the angular motion of 365$^2$ + 25° 32' is to 360', so is 27$^2$ 20th to 25° 15th 10th. Others fix the period of the sun’s rotation on his axis, with respect to the fixed stars, at 25$^2$ 10th; and they observe, that this axis is directed towards a point about half way between the pole star and Lyra, the plane of rotation being inclined a little more than 7° to that in which the earth revolves.

This motion of the spots is from west to east; whence we conclude that of the sun, to which the other is owing, to be from east to west. For the various appearances of the four spots, their cause, &c. see MACULAE and SPOTS.

Under the articles to which we have referred, a brief account is given of Dr. Herchel’s hypothesis with regard to the physical construction of the sun and the spots observed on his surface: we shall here present our readers with a more detailed account of this hypothesis. Dr. Herchel has found it convenient to lay aside the old names of spots, nuclei, James, faculae, and lucubi, because they are figurative expressions that may lead to error. Instead of these, he adopts the expressions of openings, shallow, ridges, nodules, corrugations, indentations, and pores.

Openings, he says, are those places where, by the accidental removal of the luminous clouds of the sun, its solid body may be seen; and this not being lucid, the openings through which we see it may, by a common telescope, be mistaken for mere black spots, or their nuclei.

Shallow are extensive and level depressions of the luminous solar clouds, generally surrounding the openings to a considerable distance. As they are less luminous than the rest of the sun, they seem to have some diffuseness, though imperfect, resemblance to penumbrae; which might occasion their having been called so formerly.

Ridges are bright elevations of luminous matter, extended in rows of an irregular arrangement.

Nodules are also bright elevations of luminous matter, but confined to a small space. These nodules, and ridges, as account of their being brighter than the general surface of the sun, and also differing a little from it in colour, have been called faculae, and luculi.

Corrugations, he calls that very particular and remarkable unevenness, ruggedness, or asperity, which is peculiar to the luminous solar clouds, and extends all over the surface of the globe of the sun. As the depressed parts of the corrugations are less luminous than the elevated ones, the disk of the sun has an appearance which may be called mottled.

Indentations are the depressed or low parts of the corrugations; they also extend over the whole surface of the luminous solar clouds.

Pra
The appearances, which have been called spots in the sun, are real openings in the luminous clouds of the solar atmosphere, he evinces by a number of observations. His next series of observations is added to prove, that the appearances which have been called penumbrae, are real depresions, or hollows. These are followed by others, also of the same kind as before, that ridges are produced above the general surface of the luminous clouds of the sun; that nodules are small, but highly elevated, luminous places; that corrugations confine elevations and depressions; that the dark places of corrugations are indentations; and that the lower places of indentations are pores. Hence he infers, that the several phenomena above enumerated could not appear, if the shining matter of the sun were a liquid; since by the laws of hydraulics, the openings, hollows, indentations, and pores would instantly be filled up, and that ridges and nodules could not preserve their elevation for a single moment. Whereas, many openings have been known to last for a whole revolution of the sun, and extensive elevations have remained supported for several days. Much less, he says, can it be an elastic fluid of an atmospheric nature, because this would be fill more readily to fill up the lower places, and expand itself to a level at the top. It remains, therefore, to allow this shining matter to exist in the manner of empyreal, luminous, or phosphoric clouds, residing in the higher regions of the solar atmosphere. This opinion is illustrated and confirmed by a variety of observations. From these observations, it is inferred that the corrugations are caused by a double stratum of clouds; the under stratum, or that which is next to the sun, consisting of clouds less bright than those which compose the upper stratum, and probably not unlike those of our planet. These double regions of clouds are thought to afford us sufficient proof of the existence of a solar atmosphere; which atmosphere is of great density, and, like our's, subject to considerable agitation. These agitations indicate, that there is some clear atmospheric space, between the solid body of the sun and the lower region of the clouds. It also appears, that the gases of the solar atmosphere are transparent; because our author's observations prove his being able to see the reflected light of the corrugations from their indentations, and of the self-luminous regions in general, from the hollows which they surroun and illuminate. In order to explain the generation of hollows, it is presumed from actual observation, that a transparent elastic gas comes up through the openings, by forcing itself a passage through the planetary clouds. This elastic gas is constantly formed, and ascends everywhere, by a specific gravity less than that of the general solar atmospheric gas contained in the lower regions. When it goes up in moderate quantities, it makes for itself small passages among the lower regions of clouds, which are called pores. When this gas, denominated empyreal, has reached the higher regions of the sun's atmosphere, it mixes with other gases, which, from their specific gravity, reside there, and occasional decompositions which produce the appearance of corrugations, the elevated parts of which are small self-luminous nodules, or broken ridges. Between the interfaces of these self-luminous clouds, which are ascertained not to be closely connected, the light reflected from the lower clouds will be plainly visible, and being much less intense than the direct illumination from the upper regions, will occasion the faint appearance called indentations. The mixed light, partly reflected from these indentations, and partly emitted directly from the higher parts of the corrugations, will resemble a mottled surface.

When a quantity of empyreal gas, more than what produces only pores in ascending, is formed, it will make for itself small openings; or, meeting perhaps with some resistance in passing upwards, it may exert its action in the production of ridges and nodules; and lastly, if still further an uncommon quantity of this gas should be formed, it will burst through the planetary regions of clouds, and thus will produce great openings; then spreading itself above them, it will occasion large spaces and, mixing afterwards gradually with other superior gases, it will promote the increase, and afford the maintenance of the general luminous phenomena.

If this account of the solar appearances should be well founded, we shall have no difficulty in ascertaining the actual state of the sun, with regard to its energy in giving light and heat to our globe; and nothing will now remain, but to decide the question, which will naturally occur, whether there be actually any considerable difference in the intensity of light and heat emitted from the sun at different times.

From other observations, which we cannot detail without far exceeding our prescribed limits, Dr. Herschel is induced to suppose, that the appearance of copious spots indicates the approach of warm seasons on the surface of the earth; and he has endeavoured to maintain this opinion by historical evidence; connecting the varying temperature of our atmosphere with the appearance and disappearance of the solar spots. The spots or hollows, which our author considers as parts of an inferior stratum consisting of opaque clouds, are, as he thinks, capable of protecting the immediate surface of the sun from the excessive heat produced by combustion in the superior stratum, and perhaps of rendering it habitable to animated beings. But if stars are suns, and suns are habitable, a very extensive field of examination is thus opened to our view. Dr. Herschel's hypothesis, however ingenious and consonant to the observations by which he supports it, is liable to some objections. If we inquire into the intensity of the heat, which must necessarily exist, wherever the above-mentioned combustion is performed, we cannot avoid the conviction, that no clouds, however dense, could impede its rapid transmission to the parts below. Besides, the diameter of the sun is 111 times as great as that of the earth; and at its surface, a heavy body would fall through no less than 450 feet in a single second; so that if every other circumstance permitted human beings to reside upon it, their own weight would prevent an insuperable difficulty, since it would become nearly thirty times as great as that upon the surface of the earth, and a man of moderate size would weigh above two tons. Some of the most celebrated astronomers have imagined, from the comparative light of different parts of the sun's disc, or apparent surface, that he is surrounded by a considerably denser and extensive atmosphere, imperfectly transparent; conceiving that, without such an atmosphere, the marginal parts, which are seen most obliquely, must appear considerably the brightest; but this opinion, says Sir William Young, is wholly erroneous, and the inferences that have been drawn from it, respecting the sun's atmosphere, are consequently without foundation. See ZODIALCAL LIGHT.

Those who have maintained that the substance of the sun is fire, argue in the following manner: the sun flames, and his rays, collected by concave mirrors, or convex leaves, burn, consume, and melt, the most solid bodies; or else convert them to ashes, or glafs; wherefore, as the force of the solar rays is diminished, by their divergency, in a duplicate ratio of the distances reciprocally taken; it is evident, their force and effect are the same, when collected by a burning
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ing lens, or mirror, as if we were at such distance from the fun, where they were equally dense. The fun’s rays, therefore, in the neighbourhood of the fun, produce the same effects, as might be expected from the most vehement fire: consequently, the fun is of a fiery substantiae.

Hence it follows, that its surface is everywhere fluid, that being the condition of flame.

Indeed, whether the whole body of the fun be fluid, as some think; or solid, as others; they do not presume to determine: but as there are no other marks, by which to distinguish fire from other bodies, but light, heat, a power of burning, consumming, melting, calcining, and vitrifying; they do not see what should hinder, but that the fun may be a globe of fire, like our’s, invested with flame; and supposing that the maçule are formed out of the solar exhalations, they infer that the fun is not pure fire; but that there are heterogeneous particles mixed along with it.

Philosophers have been much divided in opinion with respect to the nature of fire, light, and heat, and the causes that produce them: and they have given very different accounts of the agency of the fun, with which, whether we consider them as substantiae or qualities, they are intimately connected, and on which they seem primarily to depend. Some, among whom we may reckon Sir Isaac Newton, consider the rays of light as composed of small particles, which are emitted from shining bodies, and move with uniform velocities in uniform mediums, but with variable velocities in mediums of variable densitie. These particles, they say, act upon the minute constituent parts of bodies, not by impact, but at some indefinitely small distance; they attract and are attracted; and in being reflected or refracted, they excite a vibratory motion in the component particles. Others, as Boerhaave, represent fire as a substantia fuis generis, unalterable in its nature, and incapable of being produced or destroyed; naturally existing in equal quantities in all places, imperceptible to our senses, and only discoverable by its effects, when, by various causes, it is collected for a time into a less space than that which, from its tendency to an universal and equable diffusion, it would otherwise occupy. This matter of the fun is not supposed to be derived from the fun in any wise: the solar rays, whether direct or reflected, are of use only as they impel the particles of fire in parallel directions: that parallelism being destroyed, by intercepting the solar rays, the fire instantly assumes its natural state of uniform diffusio. According to this explanation, which attributes heat to the matter of fire, when driven in parallel directions, a much greater must be given, when the quantity so collected is amassed into a focus; and yet the focus of the largest luminary does not heat the air or medium in which it is found, but only bodies of densitie different from that medium.

M. de Luc, in his Lettres Physiques, is of opinion, that the solar rays are the principal caufe of heat; but that they only heat such bodies as do not allow them a free passage. In this remark he agrees with Newton; but then he differs totally from him, as well as from Boerhaave, concerning the nature of the rays of the fun. He does not admit the emanation of any luminous corpuscles from the fun, or rather self-luminous substantiae, but supposes all space to be filled with an ether of great elasticity and small densitie; and that light confints in the vibrations of this ether, as found confits in the vibrations of the air. Upon Newton’s supposition, says an excellent writer, the caufe by which particles of light, and the corpuscles constituting other bodies, are mutually attracted and repelled, is uncertain. The reason of the uniform diffusio of fire, of its vibration, and repercussion, as stated in Boerhaave’s opinion, is equally inexplicable; and in the last-mentioned hypothesis, we add to the other difficulties attending the supposition of an universal ether, the want of a first mover to make the fun vibrate. Of these several opinions concerning elementary fire, it may be said, as Cicero remarked concerning the opinions of philosophers concerning the nature of the soul: “Harum inintellectualium qua vera sit, Deus aliquis viderit; quae veridimilius, magna queso elius.” Watson’s Chem. Eff. vol. i. p. 154.

For a farther account of these opinions, see Fire, Heat, and Light. Dr. Herchel’s opinion has been stated at large in this article, and also under Macule, &c.

The figure of the fun is a sphericoid, higher under its equator than about the poles. This we prove thus: the fun has a motion about its own axis; and therefore the solar matter will have an endeavour to recede from the centres of the circles in which it moves; and that with the greater force, as the peripheries of the circles are greater: but the equator is the greatest circle; and the extent towards the poles, continually decrease; therefore the solar matter, though at first in a spherical form, will endeavour to recede from the centre of the equator farther than from the centres of the parallels.

Consequently, since the gravity by which it is retained in its place, is supposed to be uniform throughout the whole fun; it will really recede from the centre more under the equator than under any of the parallels; and hence the fun’s diameter, drawn through the equator, will be greater than that passing through the poles, i.e. the fun’s figure is not perfectly spherical, but spheroidal.

Befides the fun’s rotation about its axis, ascertained by the spots on its surface, it has another motion, which is a kind of agitation round the centre of gravity of the sytem, occasioning a change of place, and dependent on the motions of the planetary bodies that surround it. This kind of motion was long ago inferred from theory only, but it has been actually demonstrated by modern observations. Supposing all the planets to be in conjunction, or nearly in the same direction from the fun, the common centre of the sun’s revolution round the common centre of gravity of the sytem must be undisturbed by any reciprocal actions or revolutions of the bodies composing it, the fun must describe an irregular orbit round this centre, its great distance from it being equal to its own diameter. We may form an idea of the magnitude of this orbit by a comparison with the orbit of the moon: a body revolving round the fun, in contact with its surface, must be nearly twice as remote from its centre as the moon is from the earth, and the sun’s revolution round the common centre of gravity of the sytem must therefore be, where it is most remote, at four times the distance of the moon from the earth.

The fun, like many other stars, has probably a progressive motion, which is supposed, from a comparison of the apparent motions of a great number of the stars, to be directed towards the constellation Hercules. It is beyond doubt that many of the stars have motions peculiar to themselves, and it is not certain that any of them are without such motions; it is, therefore, in itself, highly probable that the fun may have such a motion. But Dr. Herchel has confirmed this conjecture by arguments almost demonstrative. He observes, that the apparent proper motions of forty-four stars out of fifty-six are very nearly in the direction which would be the result of such a real motion of the solar sytem: and that the bright stars Acrurus and Sirius, which are probably the nearest to us, have, as they ought to have, the greatest apparent motions. Besides, the stars...
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Ctllor appears, when viewed with a telescope, to consist of two stars, of nearly equal magnitude; and though they have both a considerable apparent motion, they have never been found to change their distance a finger second; a circumstance which is easily understood, if both their apparent motions are ascribed to a real motion of the sun, but which is much less probable, on the supposition of two separate and independent motions. See Star.

For the apparent, diurnal, and annual motions of the sun, see Earth.

Sun, Density, Diameter, Distance, Magnitude, and Parallax of the. See each article, and Planets.

Sun, Apparent Diameter of the. See Diameter.

Sun at the Horizon, Apparent Magnitude of the. See Apparent Magnitude.

Sun, Altitude of the. See Altitude and Meridian Altitude.

Sun’s Altitude, Tables of the. See Dial.

Sun, Angle at the. See Angle.

Sun, Diurnal and Nautical Arc of the. See Arc.

Sun, Cycle of the. See Cycle.

Sun, Declination of the. See Declination.

Sun, Eclipse of the. See Eclipse.

Sun, Nadir, Place, Retrogradation, and Vertical of.

See the several articles.

Sun, Rayns of the. See Rain.

Sun-Burning, in Medicine. See Ephemis.

Sun-Drosera.

Ros folis is recommended by some as a great cordial, and good for consumptions, convulsions, and the plague. Formerly a cordial wine, in which this herb, with several spices, as a principal ingredient, was in great repute, under the name of rogefola, though now almost out of date. Miller’s Bot. Off.

Sun-Fish, Mola, the Tetrodon mola of Linnaeus, and a species of ophicephalus in the Arctedent Sytem, in Ichthyology, a fish of a very singular figure. Its body is broad and short, and its hinder extremity is terminated by a circular fin, which serves it for a tail; so that it looks like the head of a large fish ferried from its body; it is frequently of two feet in length, and sometimes very much exceeds that size, growing even to two hundred weight. It has no scales, but is covered with a hard, hardish, and rough skin. Its back is black, and its belly white; the sides are of a middle colour between both. Its back and belly both terminate in a narrow edge. Its mouth is very small for the size of the fish, and, when open, is round. Its jaws are hard, and edged like a knife within; externally they are rough, as if befiled with several rows of small teeth. The head does not at all project from the rest of the body. The eyes are very small. The gills are only two elliptic holes, covered with their proper membranes. Its flesh is very soft, and its bones are all grizzled and tender. The skin tacks very firmly to the flesh, and is not easily taken off. It is caught in the Mediterranea, and sometimes in the British seas. Willoughby’s Hist. Pisc. p. 151.

Mr. Pennant describes the sun-fish of Mount’s Bay, under the title of the oblong didon. In form, he says, it resembles a blunt, or spool-shaped fish cut off in the middle; the mouth is very small, and contains in each jaw two broad teeth with sharp edges; the eyes are little, having before each a small semilunar aperture; the pectoral fins are very small, and placed behind them; the dorsal fin, and the anal fin, are high, and placed at the extremity of the body; the tail-fin is narrow, and fills all the abrupt space between those two fins; the colour of the back is darkly and dappled; the belly silvery; between the eyes and the pectoral fins are

freaks pointing downwards; the skin is free from scales; the meat of the fish is uncommonly rank; it feeds on shellfish. Care, says Mr. Pennant, must be taken not to confound this fish with the sun-fish of the Irish, which in all respects differs from it. The former, or tetrodon mola of Linnaeus, which he calls short didon, differs from the latter in being shorter and deeper; the back and anal fins are higher, and the aperture to the gills not semilunar, but oval; the situation of the fins is the same in both.

One of these fishes, of five hundred weight, was taken in 1754, near Plymouth; and on boiling a piece of the flesh, to try how it would take, (as some authors have described it as a fine fish for the table,) it was found, instead of a firm mass, to be all converted, in a few minutes, into a perfect jelly, so that it could not be taken out otherwise than with a spoon. In colour and consistence this jelly resembled boiled flesh when cold, and had little or nothing of a fishy flavour, but a very agreeable taste; it stuck firmly to the lips, however, and to the fingers, appearing very remarkably glutineous: and as the ancients had no other glue than one made of fish, this jelly was tried, as to its flocking quality, on leather, and on paper, and was found to answear as well as common pate; but by some accident it was not tried upon wood.

It will be extremely worth while, on some other opportunity, to try whether a true ichthyocolla may not be prepared by boiling down its jelly. Philos. Tran. N. 456. P. 143. Abr. vol. ix. p. 73. &c.

Sun-Fish is also a name sometimes given to the hussing shark.

Sun-Flower, in Botany. See Helianthus.

Sun-Flower, in Agriculture, a well-known annual plant of large growth, and considerable produce, which has lately been introduced into field culture with utility and advantage, in several different views. It is the helianthus annus of botanical writers, and supposed to be a native of Mexico, in South America; though it would seem to be indigenous to many different parts of the world. It is said to be very wild, though of small growth, in the southern districts of Africa; be not unknown in China, and to be extremely common in the East Indies, where it is designated the sooroa mao-ky, or sun-flower.

Soil and Situation.—The plant, which is of a hardy nature, thrives well, and, raised by seed, admits of considerable latitude in regard to the nature or quality of soil, on which it may be grown with advantage, where there is sufficient depth, strength, and moisture, for the plants to derive proper support and nourishment from them.

The situations in which they are grown should consistantly be open, and exposed as much as possible to the warmth of the sun; as the crops in such not only ripen and fill the seed better, but the plants are of a considerably larger growth than in those which are close and confined. In preparing the ground for this sort of crop, it should not be rendered light by too much ploughing, but be in a rather firm state of mould in the more superficial parts; being always, however, as clean and free from all sorts of weeds as possible. Where manure can be spared, it may be ploughed in, or prepared in the land by furrows near to the time of sowing the seed as may be convenient.

In choosing seed for this crop, as in most other cases, the hardest, finest, fullest, and plumpest, and that which has been the best ripened, should always be preferred as much as possible; as it is from such that the best and most perfect crops are raised. The seed for this purpose, too, should constantly have been kept and preserved in a dry, airy situation or place, so as not to have had any tendency to throw

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out things or sprouts. And the practice of swimming it, before it is put into the ground, is proper and beneficial, in order to remove any light and imperfect seeds that may be present.

Three or four quarts of seed, but mostly the first quantity, will be sufficient for an acre of land, if double dibbled, which is not the produce of more than half a score plants. In seeding the plants, the finest and thickest of which are in the most open exposures should be chosen for the purpose, letting them remain until they are perfectly well ripened, and chiefly making use of the large principal heads only; the seeds, when threshed out, being safely kept out of the way of moisture.

The time of sowing the feed must, in some measure, be regulated by circumstances; but the more early, in general, the feed can be got into the ground in February, or the succeeding month, the better, as the crops will become ripe and ready the sooner in the latter end of the summer, or the beginning of the autumn, which is of much importance in securing them.

There are different methods of sowing. It is probable that, in many cases, it might be most conveniently sown in flight drills, made at the distance of about a foot, or eighteen inches, according to the nature or quality of the soil, by an implement constructed for the purpose, so as to form the drills, and drop two or three seeds only, at such different spaces, into them, covering them by a following chain or light roller, as practised for turnip seed. Or they might be let by the dibble, as practised for wheat, at such distances apart; or in the quinquex order, as some have proposed, which, it is said, augments the distance of the plants near a foot, but is not so convenient in cleaning the crops. But others think, that the seed should be dibbled in after the manner of beans, the ground being previously levelled by means of a light barley-roller, and one, or perhaps two, seeds being then dropped into each hole; then the roller should be again passed over the ground, in order to close the holes in upon the feed, and prevent its being disturbed by the harrow, which should afterwards follow and conclude the busines.

Any mode which is capable of affording the means of placing the feed at equal, regular depth and distance, and of covering it well from being destroyed in any way, as ensuring a more regular, perfect, and certain growth in the plants, and promoting their more equal ripening, would be of advantage, as the plants would thereby be made to ripen more uniformly together; be sooner dry in the sheaf or bundle, and the work of threshing out the feed be more perfectly, easily, and readily performed. Such a contrivance could require little difficulty, trouble, or expense, and might answer for some other purposes of plants of this sort, which, though they do not transplant or remove well without balls of earth about their roots, may still be raised from seed in small beds only, or be thinned out from the general crops, in that way, for supplying and filling up any breaks or defects that may arise or take place from the failure of feed, or any other cause. This sort of work must, however, in all cases, be carefully done; and in such water be given at the same time, and for some days afterwards, if the weather be not moist.

The plants being supposed to arise, either at large intervals in rows at one foot apart, or at twelve-inch intervals with three feet distances in the row, would take about 14,520 to an acre of land.

In the culture of crops of this sort, the land between the plants is, from the first, to be kept quite clear from all sorts of weeds, but especially while they are in their infant state of growth. And as soon as they are ripe sufficiently above the surface of the land, the supernumerary plants should all be well thinned out by the hoe, where they are not waited for filling up any vacancies that may have occurred in the crops; but where this is the case, it should be done by a small spud, or garden-trowel with a long handle, so as to preserve the mould about their roots as much as possible, as they do not transplant well without this. In all cases where there are proper distances or spaces preferred between the rows, the work of after-culture may be readily accomplished by means of a single horse-hoe plough, contrived for the purpose, so as to cut up the weeds, lift the mould well, and lay it up a little to the roots of the plants. The parts between the plants in the rows, where necessary, may be cleared and cleaned by a small, light hand-hoe. Where, from the nature and quality of the land, the plants rise to a great height, they may be pruned, and some of the lower branches may often be taken of early, with great advantage to the crops in their growth, and the production of seed.

As to the best mode of harvesting these crops of this sort, some have thought that pulling up the stalks by the roots, in dry weather, is a better practice than that of reaping or cutting them over by the surface of the land, not only on account of their woody nature, but as preventing the lodging of the feed, especially where they are not grown upon a very stiff bound soil. The roots are to be well cleaned from all dirt, before threshing the feed out, for the sake of the sample. As the seeds readily quit the heads when perfectly dry, they can be easily threshed out.

After being pulled or cut, they may probably remain out until quite dry, but it is not so convenient in cleaning of materially injuring them. They may be bound up together with tarred twine, and be put up in small packs or parcels, in sheaves of small sizes; the heads being made to incline inward, in order that they may sooner become dry. As soon as they are become perfectly dry and well cured, they are, in large crops, either to be stacked up somewhat in the manner of other grain, or, in cases where they are only of small extent, to be headed and collected gradually, from time to time, as the flowers or heads become ripe, and a fork, proper basket, or other contrivance; depthing the heads, where necessary, upon a fort of hurdles or racks, arranged in tiers one above another for the purpose, and placing them under large, open, airy shed-buildings; or, in some instances, they may be strung on proper small comb, by means of holes made through the middle of each head; being thus suspended in the open air and sun, so as to have the full drying influence of the atmosphere.

When well cured and sufficiently dry, the seed may be threshed out, and put by for future use; being preferred in a similar manner to corn, either in granaries, or other convenient dry places. Where the heads are cut into half, they may be safely houset with little or no loss of feed. Crops of this kind may stand out in the field, in case of necessity, until late in the autumn, without much danger.

The gradual taking off the heads, too, as they become ripe, where that method is practised, often greatly prevents the depredations of birds, and other vermin, as well as the shedding and dropping of the feed upon the ground, by which great loss may sometimes be sustained. Crops of this kind are not much exposed to diseases, such as blight, mildew, or others of a similar sort; but are, for the most part, in a blooming healthy state. And though some infects may fix and shelter themselves on the flowers or heads, they cannot, from the close compact state of the feed in them, lodge in their intercepts; consequently the tom-tits, which are per-
The sun's greatest enemies are those crops, may not only seek the insects as their food, but at the same time plunder the seed of the flowers; as it is certain, and well known, that they not unfrequently work it out of the heads, even before it gets fully ripe. The capability which these birds possess of suspending their bodies in a backward direction upon the flowers, also tends to facilitate their getting out the seeds from the heads. Such birds are not, however, numerous in any situation. Rats and mice, too, often commit great depredations on these crops, separating the infusible of the seeds from the outer coats of them, in somewhat the same manner as squirrels do nuts, consuming the inner parts, and rejecting the hulls; they shou'd, therefore, be well secured from them.

The expense of these crops cannot be very great, either in the preparation and culture of the land, or in the management and securing of the produce afterwards. As to the produce of this sort of crop, it must be very different, according to the seafon, the nature of the culture which is made use of in raising it, the care that is taken in its growth and after-management, and the kinds of the plants that are employed for the purpose, as well as some other circumstances of less importance. But when grown with care, in a suitably open manner, and in good seafons, the produce will mostly be very abundant. Some have stated it so high as upwards of fifty bushels the acre, supposing each plant, on the average, to afford nearly the quantity of a pint of seed; but taking it at half this quantity, which is probably near the mark, when properly cultivated, the produce will be sufficient to fully repay the farmer, and leave him a very ample profit.

This is a sort of crop which is capable of being used and applied for many different purposes; as for feeding and fattening many forts of animals, in different ways, for drawing and forming a fine oil from, for the use of the clothier, the printer, and others; for the use of the fibrous and other parts, in the making of pack-thread, paper, and other manufacturing purposes; for the purpose of fuel in the roots, naked items, and some other parts; and probably for some other uses and purposes, to which it has not yet been much applied.

In the feeding of animals, the feed, being of a farinaceous, oily quality, may be given as a cheap, substantial, and nourishing food to near cattle, horses, sheep, pigs, rabbits, and poultry of all sorts.

In the feeding of near cattle with it, it may be used either in the reduced mealy state, or that of cake, after it has been expressed or manufactured for oil. This crop is said sometimes to be cultivated in America, as green food for cattle.

For horses it may be used as their usual food, either in the natural, or bruised, broken, and reduced states; which latter is probably the best, not only as digesting more readily, and going much further, but as improving the table, and rendering the substance more agreeable to the animals. It may be mixed with a little bran at first. There can be no doubt of the utility and advantage of this sort of provender for all sorts of working animals of this kind.

As to sheep, they must have this sort of food given to them in the mealy state, or that of the hulky matter, they being mixed with suitable quantities of wheat-bran or pollard. In this way it may feed such animals very well, and with some advantage.

For pigs or swine, too, it should always be given in the coarse, reduced, mealy state, either in the solid form, or in that of soup or wash.

For rabbits this sort of food may be made use of in different states, but it is probably best employed in the state of feed or meal, in mixture with bran or pollard, as the animals are very fond of it in these ways. The bulky chaffy material may likewise be used in the same way, as a dry food, in some cases, with great benefit. While using such food, the animals are said to look extremely sleek and well in their coats, and to frisk about and drum the floor with their hinder feet, which are the true signs of health and condition.

Poultry of most forts soon become fond of this food in its feed state, and it supports and keeps them very well; but it may probably be given to them with more advantage in the state of coarse meal, in mixture with mashed potatoes or soaked bran.

Pheasants, in the domestic state, are said also to have been often fed with this sort of food; as well as tame pigeons, in some cases, and partridges, and some other birds, with complete successe, and in a superior manner to most sorts of corn feeding.

The refuse plants may be employed as the foundations in littering of farm-yards, as well as for some other purposes about them, as wattled defences, divisions, fences, and covering for the sides of sheds, &c.

The flowers, too, afford considerable supplies of honey and wax to bees, which may be of great importance in many situations.

There is an oil capable of being prepared from these seeds, which is said to be of the fine almond kind, and which may be applied to different purposes in the arts. In the East Indies, eight quarts of this fine transparent oil is said to have been produced from about eighty pounds of the clean feed, which had been grown and ripened in a suitable situation. There is a sort of oil, from the process of making it, which may be made use of as noticed above.

The manufacturing of this oil has also been already practiced in some parts of this country; and the plant is said to have been actually cultivated in the field, in France, in this intention. There can, therefore, be little doubt of its utility in this way.

At the above rate, the produce of oil on the acre would be very great indeed, as that space would afford upwards of two hundred bushels feed, two of which would be more than the weight then stated; but supposing it to yield one-third, or even a half less, the produce in oil would be fully sufficient to encourage the cultivation of these crops; and the refuse, or cake, would amply repay the expenses incurred in the process of milling.

The oil is applicable to the uses of the clothier, in softening and preparing the wool for the card and the loom. It is equal in value, for this use, to the rancid and spoiled Florence or tallow oil; the animal oils being unfit for this purpose. It is, of course, worth four or more shillings the gallon, in this application. But it is capable of other more valuable uses, as for book-printing, burning in lamps, where pureness and brilliancy are required, and some other purposes in the arts, where the finer sorts of oil are necessary. It has been found to be particularly well adapted to the printing bruna of the American printers.

The strong fibrous and some other parts of the plant may be useful for the purpose of manufacturing into pack-thread, instead of hemp; and for the making of paper, in which intention the white, shining, silver, fibrous substance, which is contained in a large proportion, is more desirable at the attention of the manufacturer than any other part.

The large roots, naked items, and some other waste parts, may, in many places, be converted with advantage to the purposes of fuel. They may be made use of in the billet or
other forms, for drying malt, and other familiar uses, in some places; and be used in this and other ways as common fuel, and be sublimated as chips for lighting of fires, in the dried state, near large towns.

It is not improbable but that this sort of crop may be applicable to some other purposes, to which it has not yet been thought capable of being applied. It may, therefore, be concluded, that this plant may now not only be cultivated for the purpose of ornament, but for a variety of economical uses and applications of the farmer and the manufacturer, as well as some domestic purposes. It may also be found useful and beneficial with hemp, in the cultivation and improvements of land and marsh kinds, as drinking up and throwing off a large quantity of moisture. It may consequently hereafter be found a plant of great utility and consideration to the farmer and manufacturer, as well as to the gardener.

**Sunflower, Baffard.** See Helianthus. Sunflower, Dwarf, Helianthemum, or Cissus. See Helianthemum and Cistus.

The root of helianthemum, taken internally, is esteemed good against the bites of serpents: and the tops are effectual for the same purpose. The plant is astringent, and a good demulcent, in the form of a decoction, particularly in diarrhœa, hemorrhois, and ulcers of the fauces. J. Bauhin says, it is good in all disorders attended with a flux of any kind.

**Sunflower, Dwarf American.** See Rudbeckia.

**Sun Flower, Tick-seed.** See Corokia. **Sun-Plant of Hindooeifan.** See Son.

Sun-Starched, a term used by our Gardeners, in some parts of England, to express a deftremation of fruit-trees, owing to the sun's affecting them too forcibly and too suddenly; the consequence of which is the loss and withering of the fruit. Such trees only are subject to this as are planted in places sheltered from the burning sun, and only open to the sunner's, and it may always be cured by proper waterings.

**Sun-Spurry, in Botany.** See Euphorbia.

**SunAMOOKY, in Geography, a town of Bengal; 12 miles N. of Bihilpore.**

SUNAPEE, a lake and mountain of America, in Cheshire county, New Hampshire. The lake is about 8 or 9 miles long and 3 broad; and communicates by Sugar river, to the Merrimac, at the distance of 14 miles W. The mountain is situated at the S. end of the lake.

SUNBURSAH, a town of Hindooefan, in Bahar; 58 miles E.S.E. of Hajipur.

SUNBURY, a county of New Brunswick, on the river St. John, at the head of the Bay of Fundy, containing eight townships, viz. Conway, Gagetown, Barton, Sunbury, St. Anne's, Wilwot, Newton, and Mangerville. The three last were settled from Massachusetts, Connecticut, &c. The lands are generally level, tolerably fertile, and abounding with timber. Alto, the chief town of Northumberland county, Pennsylvania, situated on the E. side of Susquehannah river, just below the junction of the E. and W. branches of that river, in N. lat. about 40° 52'. The town is regularly laid out, and contains a court-houe, brick jail, a Presbyterian and German Lutheran church, and 700 inhabitants; about 76 miles above Reading. Alto, a township of Delaware county, is the district of Ohio, containing 656 inhabitants. Alto, a port-town and port of entry in Georgia, pleasantly situated in Liberty county, at the head of St. Catherine's Sound, on the main, between Medina and Newport rivers, about 15 miles S. of Great Ogeechee river. The town and harbour are defended from the fury of

the sea by the N. and S. points of St. Helens and St. Catherine's Island; between them is the bar and entrance into the Sound; the harbour is capacious and safe, and has ample anchorage for ships of great burden. It is an agreeable and healthy town, and the resort of the planters from the adjacent country during the sickly season. It has been rebuilt since the war, when it was destroyed by fire. An academy was established here in 1788; 40 miles S. of Savannah.

SUNBUY, a town of Hindooefan, in Bahar; 12 miles S. of Patna.

SUNCHEULI, a mountain of Peru, in the jurisdiction of Larcazes, in which is a gold-mine.

SUNCOOK, a town of America, in Oxford county and district of Maine, now called Lovell; containing 365 inhabitants. Alto, a river of New Hampshire, which runs into the Merrimack, N. lat. 43° 51'. W. long. 71° 26'.

SUNCOPULLY, in Natural History, a name given by the people of the East Indies to a kind of sparry substance of a whitish colour, which they calcine, and afterwards give in aces, and other intermittent cafes.

It is erroneously by some supposed to be a species of arsenic; for it has none of its qualities.

SUND, in Geography, a town of Sweden, in Est Gotland; 40 miles S. of Linnemer; Alto, a town of Sweden, in the province of Varmeland; 26 miles N. of Carlshad.

SUNDA, a town of Hindooefan, in Ouide; 30 miles N.N.E. of Kairabad.

SUNDA Jlanda, a group of islands in the East Indian sea, the largest of which are Borneo, Java, and Sumatra.

SUNDA, Straits of, an arm of the East Indian sea, which runs between Java and Sumatra. The length of this channel on the Sumatra side, taken from the Flat Point to Vaban, or Hog Point, is 15 German miles; and on the Java side, from the first point or Java head, to the point of Bustain, full 20. In the mouth of this strait lies Prince's Island, which lies.

The entrance of the strait on this side affords an uncommonly pleasing prospect over the Sumatran shore; and the Flat Point, being low and covered with trees, and behind it the majestic mountains of Sumatra, rising with a gradual ascent, reaching to the clouds; further the Keizers, or Emperor's island, lying in the middle of the channel, and hence called "Drum in den Weg," i.e. "Thwart the Way," or "Middle Isle." On either side of this island a strong current runs during the whole year. Ships passing out through the Straits of Sunda often anchor in the bay of Anjer. The Dutch East India Company claims an absolute sovereignty over the Straits of Sunda.

SUNDAEV, a fortres of Ruffia, on the Ural; 60 miles S. of Uralk.

SUNDAL, a town of Norway, in the government of Dromhein, on the Driva; 66 miles S.S.W. of Dresden.

SUNDAMINUM, a town of Hindooefan, in Myajo; 25 miles E. of Rydroog.

SUNDANA. See Sandel Befia.

SUNDAY,
SUNDAY, a town of Persia, in the province of Segesta or Seistan; 66 miles S. of Kin.

SUNDAY, the first day of the week, thus called by our idolatrous ancestors, because set apart for the worship of the sun.

It is now more properly called the Lord's day, die Dominica, because kept as a feast in memory of our Lord's resurrection on this day; and Sabbath-day, because substituted under the new law in the place of the sabbath in the old law.

The appellation of "Lord's day" was adopted by the earliest Christian writers. At the time when St. John wrote the book of his revelation, the first day of the week had obtained this name (Rev. i. 10.) and this same, together with St. John's use of it, sufficiently denotes the appropriation of this day to the service of religion; and that this appropriation was perfectly known to the churches of Asia. We have reason to believe, that by the "Lord's day," was meant the "first" day of the week; because we find no trace of any lattice of the days which could entitle another to that appellation; accordingly this appellation was used both by the Greek and Latin churches. So it is styled by Clemens Alexandrinus, by Ignatius, by Dionysius, bishop of Corinth, by an African synod, and by Tertullian. Sometimes, indeed, it is simply called 

The reason why they observed this day with so much joy and gladness is said to have been, that they might gratefully commemorate the glorious resurrection of their Redeemer, which happened on that day. Accordingly St. Barnabas says, "we keep the eighth day with gladness, on which Christ arose from the dead;" and Ignatius also says, "let us keep the Lord's day, on which Christ arose from death." Justin further relates, that "on Sunday the Christians assembled together, because it was the first day of the week, on which God out of the confused chaos made the world, and Jesus Christ our Saviour arose from the dead; for on Friday he was crucified, and on Sunday he appeared to his apostles and disciples, and taught them those things which the Christians now believe." To the same purpose, Origen advises his auditors to pray unto Almighty God, "especially on the Lord's day, which is a commemoration of Christ's passion; for the resurrection of Christ is not only celebrated once a year, but every seven days." But it has been observed, that although it is not improbable that the first day of the week was thus distinguished in commemoration of our Lord's resurrection, we have no evidence in scripture that this was the case, or that it was instituted for this purpose. That this day was denominated "Sunday" at a very early period, is evinced by a variety of testimonies, which it is needless to cite. Justin Martyr and Tertullian in particular use this appellation. But though they so far complied with the Heathens as to call this day Sunday, yet they do not seem to have so far indulged the Jews as to call it the "Sabbath-day," for through all their writings they violently declaim against sabbatizing, or keeping the Sabbath-day, that is the Jewish observance of the seventh day, which we must always understand by the word "Sabbath" in the writings of the ancients, not the observance of the first day, or the Lord's day; for that was constantly celebrated: and by those who condemn the observance of the Sabbath-day, the sanctification of the Lord's day is approved and recommended, as by Justin Martyr and Tertullian, and also by Ignatius, who says in one place, "let us no longer sabbatize," and in another, "instead of sabbatizing, let every Christian keep the Lord's day, the day on which Christ rose again; the queen of days, on which our life arose, and death was conquered by Christ." The Eastern churches, however, in compliance with the Jewish converts, who were numerous in those parts, performed on the seventh day the same public religious services that they did on the first day, observing both the one and the other as a festival. Whence Origen enumerates Saturday as one of the four fasts solemnized in his time; though, on the contrary, some of the Western churches, that they might not seem to Judaize, fasted on Saturday. If it be inquired, what duties were appointed for the Jewish Sabbath, and under what penalties, and in what manner it was observed among the Jews, we are informed by the fourth commandment, a specific law from God; from work was enjoined not only upon Jews by birth, or religious profession, but upon all who resided within the limits of the Jewish state; that the same was to be permitted to their slaves and their cattle, and that this rest was not to be violated under pain of death. (Exod. xxxi. 14.) Befides, the seventh day was to be solemnized by double sacrifices in the temple. (Num. xxix. 9, 10.) Accordingly, we find in the sequel of the history of the Jews, that the Sabbath was in fact observed amongst them, by a scrupulous abstinence from every thing which, by any possible construction, could be deemed labour; as from dicing meats, from traveling beyond a Sabbath-day's journey, or about a sabbath mile. In the Maccabear war, they suffered 1000 of their number to be slain, rather than do any thing in their own defence on the Sabbath-day. In the final siege of Jerusalem, after they had so far overcome their persecutors, as to defend their persons when attacked, they refused any operation on the Sabbath-day, by which they might have interrupted the enemy in filling up the trenches. After the establishment of synagogues, it was the custom to assemble in them on the Sabbath-day, for the purport of learning the laws and explaining, and probably for the exercise of public devotion. According to the Jewish computation, the Sabbath held from 6 o'clock on the Friday evening to 6 o'clock on Saturday evening.

It has been a question of considerable interest, whether the command by which the Jewish Sabbath was instituted, extend to Christians? Some, in the discussion of this question, have supposed that the transmigration of the wilder-

ness, recorded in the 16th chapter of Exodus, was the first actual institution of the Sabbath, and that it was afterwards established with great solemnity by the fourth commandment. Whilom others contend that the Sabbath was instituted at the time of the creation, as related in the second chapter of Genesis. The principal arguments pertaining to this question, have been briefly stated under the article Sabbath. Archdeacon Paley, who adopts the opinion of those who maintain that the institution of the Jewish Sabbath first took place in the wilderness, considers, as they do, the blessing and sanctification, i.e. the religious dis-
tinction and appropriation of the seventh day, mentioned in the book of Genesis, as not having been made till many ages afterwards. He argues, that the words do not assert, that God then "blessecd" and "sanctified" the seventh day, but that he blessed and sanctified it, because he had on that day retired from the work of creation, and for that reason: and it if is asked, why the Sabbath, or sanctification of the seventh
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Seventh day, was then mentioned, if it was not then appo-
inted, our author replies, that the order of connection,
and not of time, introduced the mention of the sabbath in
the history of the subject which it was ordained to com-
memorate. This interpretation, he says, is strongly sup-
ported by a passage in the prophecy of Ezekiel, where the
sabbath is plainly spoken of as a sabbath, or, as the expression
is supposed to mean, as sabbath instilled, in the wilderness.
(Ezek. xx. 10, 11, 12.) Nehemiah also accounts the pro-
mulgation of the sabbatic law amongst the transvagions in
the wilderness, and this circumstance is considered as afford-
ing another important argument in favour of the same
opinion. (Nehem. ix. 14.) If the divine command, by
which the sabbath was instituted, was actually delivered at
the creation, as many learned writers have maintained, it
was without doubt addressed to the whole human species
alone, and continues, unless repealed by some subsequent
revelation, obligatory upon all who have the knowledge of it.
But if the command was published for the first time in
the wilderness, then it was immediately directed to the Jewish
people alone, and the sabbath ought to be regarded as part of
the peculiar law of the Jewish policy. In further sup-
pport of this latter opinion, it is alleged, that the sabbath is
described as a sign between God and the people of Israel
(Exod. xxxi. 16, 17. Ezek. xx. 16.) and that it does not
seem easy to understand, how the sabbath could be a
sign between God and the Gentiles, if there were no speci-
fic regulations as to the observance of it. The reference
was peculiar to that people, and designed to be so. The
distinction of the sabbath is, in its nature, as much a positive ceremonial institution, as that of many
other sabbaths which were appointed by the Levitical law
to be kept holy, and to be observed by a distinct rest: such
were the first and seventh days of unleavened bread;
the feast of pentecost; the feast of tabernacles; and in the 23d
chapter of Exodus, the sabbath and thefe are recited
together. It is further argued, that the observance of
the sabbath was not one of the articles enjoined by the apostles
in the 15th chapter of Acts, upon them "which, from
among the Gentiles, were turned unto God." St. Paul
evidently appears to have considered the sabbath as part of
the Jewish ritual, and not binding upon Christians as such.
Col. ii. 16, 17.

To the objection, that the reason assigned in the fourth
commandment for hallowing the seventh day, viz., "because
God rested on the seventh day from the work of the cre-
tation," pertains to all mankind, it is replied, that although
in Exodus the commandment is founded upon God's rest
from the creation, in Deuteronomy (chap. v. 13-15.) the
commandment is repeated with a reference to a different
event. If it be objected, that inasmuch as the other nine
commandments in the decalogue are confessedly of moral
and universal obligation, it may be reasonably presumed
that this is of the same, the answer is, that this argument
will have less weight, when it is considered, that the dif-
tinction between positive and natural duties, like other
distinctions of modern ethics, was unknown to the simplici-
ty of ancient language; and that there are various passages in
Scripture, which give it in a general or ceremonial, and not
positive nature, and confessedly of partial obligation, are
enumerated, and without any mark of discrimination, along
with others which are natural and universal. See Ezek.
xxviii. 5-9; and Acts, xx. 28, 39.

If the law by which the sabbath was instituted be con-
idered as a law only to the Jews, it becomes an important
inquiry, whether the founder of Christianity delivered any
new command upon the subject; or, if that should not
appear to be the case, whether any day was appropriated
to the service of religion, by the authority or example of
his apostles? The practice of holding religious assemb-
lines upon the first day of the week was so early and general in
the Christian church, that we derive from hence considerable
proof of its having originated from some precept of Christ,
or of his apostles, though no such precept be now extant.
It was on the first day of the week that the disciples were
assembled, when Christ appeared to them for the first time
after his resurrection. (John, xx. 19.) If we allow that
this might have been accidental, yet we read in the 25th
verse of the same chapter, "that after eight days," that is,
on the first day of the week following, "again the disciples
were within," which second meeting upon the same day
of the week seems like an appointment and design to meet
on that particular day. The same custom seems also to
have been observed in a Christian church at a great distance
from Jerusalem. (Acts, xx. 7.) The practice men-
tioned in this passage seems now to have been familiar and
established. (See also I Cor. xvi. 2.) From these pas-
fages we deduce ample evidence, that the Christians held
and frequented religious assemblies upon the first day of
the week. Nevertheless, a cessation upon that day from labour,
beyond the time of attendance upon public worship, is not
intimated in any passage of the New Testament; nor did
Christ or his apostles deliver, as Paley supposes, any com-
mand to their disciples for a discontinuance upon that day of
the public observance of the sabbath. They cannot be
condemned as a defect in the Christian institution by
any who consider, that in the primitive condition of Chris-
tianity, the observation of a new sabbath would have been
useless, or inconvenient, or impracticable. During Christ's
personal ministry, his religion was preached to the Jew
alone. They already had a sabbath, which, as subjects of
that economy, they were obliged to keep, and did keep.
It was not, therefore, probable that Christ would enjoin
another day of rest in conjunction with this.

Archdeacon Paley deduces from his whole inquiry in
this subject the following conclusion; viz., that the ob-
serveing upon the first day of the week for the purpose of
public worship and religious instruction, is a law of Chris-
tianity, of divine appointment; and that the resting on
the day from our employments longer than we are detained
from them by an attendance upon these assemblies, is to Christians
an ordinance of human institution; binding, nevertheless,
on the conscience of every individual of a country in
which a weekly sabbath is established, for the sake of
the beneficial purposes, which the public and regular observ-
ance of it promotes; and recompen-sating, perhaps, in some degree,
to the divine approbation, by the resemblance it bears to
what God was pleased to make a solemn part of the law
which he delivered to the people of Israel, and by its su-
fervency to many of the same uses.

We may observe, in general, that if the design of a reli-
gious assembly require that it be held frequently, it is not
expedient that it should return at fixed intervals; and that
the same sabbaths should be observed throughout the country.
That part of the religious distinction of feasts, which
originates in a political or ceremonial, and burdens
during times set apart for the exercise of public worship,
is founded in the reasons which make public worship itself
a duty. But as the celebration of divine service never oc-
cupies the whole day, the other interval of Sunday, is not
spent at church, must be considered as a mere rest
from the ordinary occupations of civil life; and he, who
Paley, who would defend the institution, as it is required
to be observed in Christian countries, unless he can produce
a command for a "Christian sabbath," must point out the
uses
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uses of it in that view. 1st, that interval of relaxation which Sunday affords to the laborious class of mankind contributes, in a great degree, to the comfort and satisfaction of their lives, both as it refreshes them for the time, and as it relieves their six days' labour by the prospect of a day of rest always approaching. In this view of the institution, whatever may be its origin, it must appear to be highly useful; nor is anything loftier to the community by the intermission of public industry one day in the week; for in countries tolerably advanced in population, and the arts of civil life, there is always more than enough of human labour.

2ndly, Sunday, by suspending many public diversions, and the ordinary rotation of employment, leaves to men of every rank and profession sufficient leisure, and not more than sufficient, both for the external offices of Christianity, and the actual, but equally necessary, duties of religious meditation and inquiry. And thirdly, they whose humanity embraces the whole sensitive creation, will esteem it no inconsiderable recommendation of a weekly return of public rest, that it affords a respite to the toil of brutes. Having fixed the obligation of Christians to comply with the religious observations of Sunday, as it arises from the public uses of the institution, and the authority of the apostolic practice, it follows of course that the manner of observing it ought to be that which best fulfills these uses, and conforms the nearest to this practice. The uses of this institution are to facilitate attendance upon public worship, or to mollify the condition of the laborious classes of mankind, and by a general suspension of business and amusement, to invite and enable persons of every description to apply their time and thoughts to subjects pertaining to their salvation. The duty of the day must, therefore, be violated; 1st, by all such employments or engagements as hinder our attendance upon public worship, or occupy so much of our time as not to afford sufficient leisure for religious reflection; such are travelling, visiting during the whole day, or employing the time at home in any kind of business that bears no relation to religion. Secondly, by unnecessary encroachments upon the rest and liberty which Sunday grants to afford to the inferior orders of the community. Thirdly, by such recreations as are unhealthily forborne, out of respect to the day; as hunting, shooting, fishing, public diversions, frequenting taverns, and playing at cards or dice.

It was Constantine the Great who first made a law for the proper observance of Sunday; and who, according to Eusebius, appointed it should be regularly celebrated throughout the Roman empire. Before him, and even in his time, they observed the Jewish Sabbath, as well as Sunday; both to satisfy the law of Moses, and to imitate the apostles, who used to meet together on the first day.

By Constantine's laws, made in 321, it was decreed, that for the future, the Sunday should be kept a day of rest in all cities and towns, but he allowed the country people to follow their work. In 358, the council of Origen prohibited this country labour; but because there were still many Jews in the Gauls, and the people gave into a good many superstitious usages in the celebration of the new sabbath, like those of the Jews among that of the old; the council declares, that to hold it unlawful to travel with horses, cattle, and carriages, to prepare foods, or to do any thing necessary to the cleanliness and decency of houses or persons, savours more of Judaism than Christianity.

It is well observed by judge Blackstone (book iv.), that besides the notorious indecency and scandal of permitting any secular business to be publicly transacted on this day, in a country professing Christianity, and the corruption of morals which usually follows the profanation of it; the keeping one day in seven holy, as a time of relaxation and refreshment, as well as for public worship, is of admirable service to a state, considered merely as a civil institution. It humanizes, by the help of conversation and society, the manners of the lower classes, which would otherwise degenerate into a forbid ferocity and savage selfishness of spirit; it enforces in the industrious workman a habit of going to church in the ensuing week with health and cheerfulness; it impresses on the minds of the people the sense of their duty to God, to necessitate them to make good citizens; but which would be worn out and defaced by an unremitting continuance of labour, without any stated times of recalling them to the worship of their Maker. Accordingly, the laws of king Athelian (c. 24.) forbade all merchandizing on the Lord's day, under very severe penalties. And by 27 Hen. VI. c. 5, no fair or market shall be held on the principal festivals, Good Friday, or any holidays, except the four Sundays in harvest; a pain of forfeiting the goods exposed to sale. Moreover, by 1 Jac. c. 22, no shoemaker is to expose to sale any shoes, &c. on pain of 5s. 4d. a pair; and by 2 Car. I. c. 1, no persons shall assemble out of their own parishes, for any sport whatsoever, upon this day; nor, in their parishes, shall use any bull or bear-baiting, interludes, plays, or other unlawful exercises or pastimes, on pain that every offender shall pay 5s. 4d. to the poor. By 26 Car. II. c. 7, no person is allowed to work on the Lord's day, or use any boat or barge, (unless allowed by a justice of the peace, or ferry watermen permitted to ply on the Thames, &c. 16 W. c. 21.), or expose any goods to sale; except meat in public houses, milk and milkcarrs at certain hours (10 & 21 W. c. 24.), and works of necessity or charity, or forreheit of 5%. Or if any butcher, by himself, or any other for him by his privy or content, shall kill or fell any victuals on the said day, he shall forfeit 6s. 8d. Nor shall any drayman, carrier, or the like, travel upon that day, under pain of 50s. (3 Car. c. 1.) Fifth-carriages (for the supply chiefly of the markets within London and Westminster) shall be allowed to ply on Sundays or holidays, whether laden or returning empty. No arrest can be made nor process served upon a Sunday, except for treason, felony, or breach of the peace: nor can any proceedings be had, nor judgment given, nor suppofed to be given, on a Sunday: nor shall any hundred be answerable for a robbery committed on that day.

By 9 Ann. c. 23, it shall be lawful for any licensed hackney-coachman, or his driver, or any chairman, to ply and stand with their coaches and chairs, and to drive and carry the same respectively on the Lord's day, within the limits of the bills of mortality.

By 31 Geo. III. c. 49, it is enacted, that every house, room, or other place, which shall be opened or used for public amusement, or for public debate, or any such other purpose, upon any part of the Lord's day called Sunday, and to which persons shall be admitted by the payment of money, or by tickets sold for money, directly or indirectly, shall be deemed a disorderly house or place; and the keeper of it shall forfeit 100l. for every Sunday the same shall be so used, and be otherwise punishable as the law directs in cases of disorderly houses; and the person managing the same, or acting as master of the ceremonies, or as moderator, president, or chairman, in any such debate, shall forfeit 100l., and the door-keeper, or other person delivering out tickets, 50l.; and any person advertising such amusement shall forfeit 50l. For the penalty of killing game on Sunday, see Game. For the penalty of not attending public worship on Sunday, see Nonconformists.
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By 24 Geo. III. c. 65, it is enacted, that no baker carrying on his business in the city of London, or within twelve miles of it, shall make and expose to sale any bread or rolls, or bake any meat puddings, pies, or tarts, or in any other manner exercise his trade or calling, except in the manner allowed by that act, which permits the selling of bread, and the baking of meat puddings or pies only, on the Lord's day, between the hours of 9 o'clock in the forenoon and 1 o'clock in the afternoon, so as the person requiring the bread or meat of the baker or feme to and from the place where such meat pudding or pie is baked, the penalty is 10s., and professions are to commence within six days after the offence is committed.

By 48 Geo. III. c. 70, which principally adjusts the penalties annexed to offences, any mauler or mistrefb baker is allowed within the limits of the weekly bills of mortality, and within ten miles of the Royal Exchange, to deliver to customers on the Lord's day bakings, until half an hour past one in the afternoon of that day.

In the brevity, or other offices, we meet with Sundays of the first and second class. Those of the first class are, Palm, Easter, Ascension, and Whitsunday, those of Quasquimode and Quadragesima; each of which see under its proper article. Those of the second class are the common Sundays.

Anciently each Sunday in the year had its particular name, which was taken from the introit of the day; which custom has only been continued to some few in Lent: as Reminiscere, Oculi, Lector, Judica.

SUNDAY, QUASAMODEMA. See QUASAMODEMA.
SUNDAY, TRINITY. See TRINITY.
SUNDAY, LETTER. See DOMINICAL LETTER.
SUNDAY RIVER, in Geography, a river of Southern Africa, on the south coast of the Cape Colony, which falls into Algoa, or Zwart Kop's bay, opposite to the island of Saint Croix. It rises in the midst of the Snowy mountains, and contains a permanently flowing stream, broad and shallow in the middle part of its course, and narrow and deep towards the mouth, which, like the other rivers, is choked with a bed of sand. This, as well as the other rivers of the colony, is well stocked with perch, eels, and small turtle, and, to a certain degree, from the sea-coast, abounds with almost every kind of fish-fish peculiar to this part of the world.

SUNDAY SALT. See SALT.
SUNDBACH, or LANDMAT, in Geography, a river of Switzerland, which runs into the Linth, near Weinfen.
SUNDBORN, a town of Sweden, in Dalecarlia; 5 miles N.E. of Falun.
SUNDEH, a town of Sweden, in Dalecarlia; 5 miles N.E. of Falun.
SUNDEEP, or SUNDEE, an island at the mouth of the river Merga, or Burhampooter, about 100 miles in circumference; anciently belonging to Aracan. The Portuguese, in 1602, finding it naturally strong, took it from the Mogols; but the king of Aracan, jealous of their growing power, compelled them in the next year to retire. N. lat. 22° 29'. E. long. 91° 33'.
SUNDER, Ta, in Agriculture, a provincial term, signifying to air and expel to the fun and wind, as hay that has been cocked up without being fully dry, and is repressed out.
SUNDERAGODA, in Geography, a town of Hindoostan, in the circular of Cisacole; 5 miles S.E. of Kemedy.
SUNDERGOP. See SUNDERBORG.
SUNDERBUNDS. See DELTA OF THE GANGES.
SUNDERDOO, or MELUNDY, a fortified island in the Indian sea, near the W. coast of Hindoostan, 10 miles to the N.E. by. N. of Vingoda rocks, and reduced by commodore James in 1765. N. lat. 5° 53' 50'. E. long. 75° 16' 30'.

SUNDERREN, a town of the duchy of Weilphala; 25 miles W. of Brlon.
SUNDERGAT, a town of Bengal; 28 miles S. of Calcutta.
SUNDERHAM. See SODERHAM.
SUNDERKIOPEI. See SODERKIOPEI.
SUNDERLAND, a borough-town in the north division of Easington ward, and county-palatine of Durham, England, is seated on the south-west bank of the river Wear, and on the high road which branches from thence to Durham, Stockton, Newcaith, and Shields. In the reign of Henry VIII., Sunderland first began to assume a separate municipal importance; at that time the conservatorship of the river belonged to the crown; but since that period separate commissioners have been appointed. Bishop Morton, in 1624, incorporated the inhabitants by the title of "Mayor, aldermen, and commonalty of the borough of Sunderland." This charter, in the unquiet times which succeeded, was suffered to expire. At the restoration of Charles II., letters patent were issued for the erection of a light-house and piers, and for the preparation of the harbour; for which purpose, various acts of parliament had already passed, since the reign of Henry VIII. Till the year 1719, this town was comprised within the parish of Bishop's-Wearmouth (see WEARMOUTH), but the population having then increased greatly, an act of parliament was procured for making the town and township of Sunderland a distinct parish; upon which a church was erected here, as a part of one of the common fields. Sunderland harbour is formed by two piers, on the north and south sides of the river; on the former of which a circular light-house was erected in 1802. The trade of Sunderland has been long in a state of progressive increase; but during the latter part of the last century has been yet more rapid. The exports are coal, lime, glai, glas-bottles, grind-stones, and copperas. The principal trade, the principal inhabitants, employs about 500 ships, exclusive of 492 keels, which convey the coal from the staiths to the large vessels. This coal is chiefly directed to the metropolis; although great quantities are sent to the Baltic, to France, and Holland; making the whole quantity annually exported from Sunderland about 315,000 Newcastle chaldrons. The number of persons employed in this trade some time since was supposed to be 36,000, or the Wear only. A good deal of linen is annually sent to Yorkshire and Scotland. Many of the inhabitants of the town are employed in the manufacture of patent rope, bottles, and broad glas, copperas, and white and brown earthenware. There are also various free-rose quarries in the neighbourhood of Sunderland. The principal buildings here are the parish-church, a chapel of ease, which has been erected on account of the increased population; meeting-houses belonging to the various sects of dissenters; the barrack; the theatre, and the assembly-room. The town also contains several charitable institutions, among which are a humane society, a dispensary, and two schools. The municipal government is vested in a mayor, aldermen, &c. Here are two annual fairs, with a weekly market on Friday. The population of Sunderland consisted, in 1811, of 12,829 persons, occupying 1684 houses. At the extremity of the town, towards Bishop's-Wearmouth, is the celebrated iron bridge over the Wear, for a particular description of which, see the article BRIDGE. (See also WEARMOUTH.)
SUN


SUNDERLAND, a township of America, in the state of Vermont and county of Bennington; 16 miles N.E. of Bennington; containing 575 inhabitants, and a lead-mine. — Allo, a township of Maitlandshire, in Hampshire county, on the east side of Connecticut river, about 40 miles N. of Hadley; containing a handsome congregation church, and 551 inhabitants, and incorporated in 1718.

SUNDERLAND FOR, a fort of the island of Barbadoes; 1 mile N. of Speights Town.

SUNDERLAND POINT, a cape of England, in the county of Lancaster, at the mouth of the river Lune; 5 miles S.S.W. of Lancaster.—Allo, a cape on the E. coast of England, and county of Northumberland, in the German Sea. N. lat. 52° 37'. W. long. 1° 44'.

SUNDERSHAUSEN. See Sondershausen.

SUNDGAW, formerly a district of Germany, on the left side of the Rhine, but now the southern part of the department of the Lower Rhine.

SUNDI, a province of Africa, in the kingdom of Congo, on the borders of the river Zaire. Its chief town has the same name.

SUNDIVA. See Sundrep.

SUNDSIO, a town of Sweden, in the province of Jamtland, on a branch of lake Storforo; 10 miles S.S.E. of Offerfors.

SUNDSTAD, a sea-port town of Sweden, in the province of Medelpad, on the W. side of the gulf of Bothnia. The harbour, about a league in length, is very convenient. The chief articles of trade are tar, bark of birch-trees, deals, linen, &c.; 20 miles S. of Herland. N. lat. 62° 47'. E. long. 17° 5'.

SUNEKOS, a river which rises in Bootan, and runs into the Burhampoteer, a little below Rangamatty, in Bengal.

SUNERAMPOUR, a town of Bengal; 40 miles N.E. of Dacca. N. lat. 24° 2'. E. long. 91° 9'.

SUNERONG, SUNNERGAUM, or SUNERGAUM, a town of Hindooftan, in the country of Bengal, formerly a considerable city, and celebrated for its manufacture of cotton; situated on one of the branches of the Burhampoteer; 14 miles S.E. of Dacca.

SUNGRA, a town of Peria, in the province of Seilkan or Segeltan; 50 miles W. of Meemend.

SUNSEEL, a town of the duchy of Warfaw; 27 miles S. of Petrograd.

SUNGRA, a town of Bengal; 26 miles S. of Ghor-dore.

SUNGUMNERE, a town of Hindooftan, in Baglan; 35 miles W. of Bahbelgong.

SUNGWAH, a town of Hindooftan, in Baglan; 14 miles N. of Amednagur.

SUNHERETE, a town of France, in the department of the Lower Pyrenées; 7 miles S. of Mauléon.

SU-NIM, a town of China, of the third rank, in Petchch-li; 27 miles S.E. of Puo-tsing.

SUNISA, a town of Afghan Turkey, in Natalia; 25 miles N. of Tocat.

SUNK ISLAND, an island on the river Humber, about two miles in length, and a mile and a half in breadth, of an oblong form, and about nine miles in circumference; separated from the coast of Yorkshire by a channel two miles broad, which is almost dry at low water. On this island are some thousand acres in cultivation, and a few inhabitants to take care of the banks; 10 miles N.W. of Spurn Head.

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the females; in regard it was required, that the victims were perfect, and without any defect; sullus, or sulus, in the language of the Ojib, signifying integer, entire. See AMBARVALIA.

SUPARABU, in Geography, a small island in the Atlantic, near the coast of Brazil. S. lat. 25° 37'.

SUPAY Ucco, or Driell's Hill, a remarkable eminence in Quito, in Peru, between the valleys of Chugui-pata, and that of Paece. It has its name from a fabulous story of enchantment, propagated by a superstitious Spaniard. It is thought to contain rich mines.

SUPERACUTE, in the Old Mufic, were such high sounds as exceeded E la, the highest note in the scale of Guido, before the term alti, or in alto, came into use. It has long been proverbial to say, in speaking of any thing in excess, alluding to the high notes in music, that a man's pride, vanity, or inflection, goes a note above E la. See ALT, SCALE, and DIAGRAM.

SUPERBIPARTIENS. See RATIO.

SUPERBUS MUSCULUS, in Anatomy, the superior straight muscle of the eye. See EYE.

SUPERCARGO, an officer charged with the accounts of the cargo, and all other commercial affairs in a merchant-ship.

SUPERCIILIARY, in Anatomy, an epithet of certain parts about the eye-brow. The superciliary arch or ridge is the bony superior margin of the orbit. The foramen or notch of the same name is placed in that arch, and gives passage to the superciliary artery and nerve.

SUPERCIILII CORRUGATOR, a small muscle of the eye-brow. See EYE.

SUPERCILIUM, in the Ancient Architecture, denotes the uppermost member of the cornice; called by the moderns corona, crowns, or lambry.

Mr. Evelyn conceives, it should rather have been called fullicium, or drip; to denote its office of sheltering the order from rain. &c.

SUPERCIILUM is also used for a square member under the upper tole, in some pedestals.

Some authors confound it with the tore itself.

SUPERCIILUM Terrae. See ADIANTUM.

SUPEREROGATION, in Theology, what a man does beyond his duty, or more than he was commanded to do.

The Romanists stand up fireniously for works of supernerogation; and maintain, that the observance of evangelical counsels is such. By means of these, a rock of merit is laid up, which the church has the disposif of, and which she distributes in indulgences to such as need.

This monstrous and absurd doctrine was first invented towards the close of the 12th century, and modified and embellished by St. Thomas in the 13th; according to which it was pretended, that there actually existed an immense treasure of merit, composed of the pious deeds and virtuous actions, which the saints had performed beyond what was necessary for their own salvation, and which were, therefore, applicable to the benefit of others; that the guardian and dispenser of this precious treasure was the Roman pontiff; and that, of consequence, he was empowered to assign to such as he thought proper a portion of this inexhaustible source of merit, suitable to their respective guilt, and sufficient to deliver them from the punishment due to their crimes.

The reformed church do not allow of any work of supernerogation; but hold with the apostles, that when we have done our best, we are but unprofitable servants.

SUPERFETATION, in Physiology, the formation of another child, in consequence of a second impregnation, in a female already pregnant. The possibility of such an occurrence has been doubted; and reasons are assigned in the article GENERATION, under the head of Physiology of the female organs, which justify that doubt. The following has been since published, under the title of "A case of superfetation," by Dr. Maton, in the fourth volume of the Transactions of the College of Physicians, p. 161. A lady, who had previously borne children, had, on the 1st of Nov. 1807, another male child, which was brought forth under circumstances peculiarly distressing; being drop on a bundle of straw at midnight in an uninhabited room. Though this infant had every appearance of health at the time of birth, he lived about nine days only. On the 2d of February, 1808, (not quite three months from the former accouchement,) it was delivered of another male infant completely formed, and apparently in perfect health. This child died in about three months of measles.

SUPERFICIAL CONTENT. See SUPERFICIAL, ELM, and MEASURING.

SUPERFICIAL FOURNEMENT, in Fortification, the same with caisson, which is a wooden chest, or box, with three, four, five, or six bombs in it. Sometimes it is filled only with powder, and used in sieges, by being buried under ground, with a train to it, to blow up any lodgment that the enemy may make.

SUPERFICIAL Hollow Earth-Drain, in Agriculture, such a drain as is formed with earthy materials, at no great depth. This sort of drain may be found useful and effective, according to Mr. Marshall, "where a basis of firm clay or strong loam, is situated beneath an absorbent subsoil, and at a convenient depth, as from twenty to thirty inches beneath the surface, being grooved out of the base, and formed with earth alone, at a comparatively small expense, even where stones or bricks are plentiful. They may be employed with effect, either to collect water from the surface, or to receive rising waters through the perforations of their basins. In forming them, a wider trench having been sunk through the soil and the subsoil, if any, a narrower groove is, it said, formed in the base, leaving a flat even shoulder, or shelf, on either side of it. On these shoulders the inverted turf, raised at the top of the trench, or collected in making surface-drains on old graps lands, and cut five or five inches thick, is laid as a cover to the groove; and upon this the excavated mould of the trench is returned." And in regard to the dimensions of a drain of this sort, they may be three; the bottom of the trench ten or twelve inches wide; the top of the groove five or six inches, narrowing to three or four inches at the bottom; its depth five or six inches. As the turf decays, the middle of the cover moulds down, and forms an arched roof to the open drain, which thus acquires an oval form. It is added, that if, in forming a drain of this construction, the bottom of it could or touch upon a vein, or a stratum, of loose earth, so that in the water more particularly lodges, it is necessary to line the pipe or operative part of the drain with turf, to prevent the sides from hollowing into, and thereby choking up the channel. If the difficult part of the operation, the wider trench is to be continued down to the bottom of the drain; and if this also require to be strengthened, a few inches lower, to receive a floor of turf. On this floor, ten or twelve inches wide, two lines of sods are set on edge, and leaning somewhat outward, so as to answer the form of the groove; and are firmly fixed in their places by the covering turfs. The joints on every side are to be left sufficiently open, to permit the waters to pass freely into the trenchlet or pipe of the drain, and close enough.
enough to prevent any gritty matter from entering it, and thereby filling it up.

Supercial Horizontal-Draining Angles, that kind of tool of the auger fort, which is employed in boring in horizontally into the land, in pits, quarries, and other similar places, at no great depth from the surface. See Spring-Draining Angle.

Superficies, or Surface, in Geometry, a magnitude, considered as having two dimensions; or extended in length and breadth, but without thickness or depth.

A surface is not a body of the least sensible magnitude, as some have imagined, but it is the termination, or boundary of a body; neither is a line to be considered as the surface of the least sensible breadth, but as a termination or limit of a surface; nor is a point to be considered as the least sensible line, but as the termination of a line; and in this sense it is plain that a point cannot be conceived to have parts, or magnitude. (See Magnitude.) See also Macaulay’s Fluxions, vol. i. p. 245; and Mr. John Bernouilli’s Letter to Monfier Coursat, concerning his Comment on the Analyse des Infiniment petits. Jo. Bernoull. Opera. vol. iv. p. 160, seq.

In bodies, the superficies is all that presents itself to the eye. A superficies is chiefly considered as the external part of a solid; when we speak of a surface simply, and without any regard to body, we usually call it figure.

Superficies, Rectilinea, is that comprehended between right lines.

Superficies, Curvilinea, that comprehended between curve lines.

Superficies, Planes, is that which has no inequality, but lies evenly between its bounding lines.

Superficies, Convexa, is the exterior part of a spherical or spheroidal body.

Superficies, Concava, is the interior part of an orbicular or spheroidal body.

The measure or quantity of a surface is called its area; which see.

The finding of this measure, or area, is called its quadrature; which see.

To measure the surfaces of the several kinds of bodies, as spheres, cubes, parallelepipeds, pyramids, prisms, cones, &c. see AREA and SPHERE, CUBE, &c.

In order to evince the use of fluxions in finding the superficies of solid bodies, let $F A F$ (Plate XIV. Analysis, fig. 6.) represent a solid generated by the revolution of any given curve $A F$ about its axis $A H$; also, let a circle, whose diameter is the variable line (or ordinate) $R B R$, be conceived to move uniformly from $A$ towards $F F$, and to dilate itself so, on all sides, at the same time, as to generate, by its periphery, the proposed superficies $R A R$; then, the length of that periphery, or the generating line, being expressed by $3.141592 	imes R R = 2 \pi R R$, and the celerity with which it moves by $\dot{z}$, the fluxion of the superficies $R A R$, or the space that would be uniformly generated in the time of describing $\dot{z}$, will therefore be truly represented by $2 \pi R R \dot{z}$.

Hence, if $w$ be taken to represent the whole surface $R A R$, generated from the beginning, we shall have $w = 2 \pi R R \dot{z} = \pi \dot{z} + \pi \dot{z}$; whence $w$ itself may be found as in the following examples.

1. To determine the convex superficies of a cone. The semi-diameter of the base $D C$ or $D C$ (fig. 7.) being put $= \ell$, the slanting line, or hypotenuse, $A C = c$, and $F G$ parallel to $D C = y$, and $c$, we shall, from the similarity of the triangles $A D C$ and $G m g$, have $b = c \cdot \frac{c}{b}$; whence $\dot{w} = \frac{2 \pi c}{y} \dot{y}$; and consequently $\dot{w} = \frac{2 \pi c}{y} \dot{y}$. This, when $y = \ell$, becomes equal $\frac{2 \pi c}{y} \dot{y} = \frac{2 \pi c}{y} \dot{y} = \frac{2 \pi c}{y} \dot{y} = \frac{2 \pi c}{y} \dot{y} = \frac{2 \pi c}{y} \dot{y}$.

For the superficies of a coneoid, &c. see CONOID.

2. To find the superficies of a sphere $A E B H$ (fig. 8.) In this case, putting the radius $O H = a$, $A E = x$, $H m = y$, &c. we shall (by reason of the similar triangles $O H F$ and $H m b$) have $y = (F H) : a (O H) = x (H m)$.

$x (H b) = \frac{a x}{y}$; therefore $\dot{w} = \frac{2 \pi a x}{y} = \frac{2 \pi a x}{y} = \frac{2 \pi a x}{y} = \frac{2 \pi a x}{y} = \frac{2 \pi a x}{y}$.

And consequently the superficies ($w$) itself is $2 \pi a x = A F \times$ periphery $A E B H$; which, if the whole sphere be taken, will become $A B \times$ periph. $A E B H = 4$ times the area $B E A H$.

Hence the superficies of a sphere is equal to four times the area of its greatest circle: and the convex superficies of any segment of it, is to that of the whole, as the axis (or thickness) of the segment to the diameter of the sphere. This, as we have already shown, is $\frac{a^2}{3} + \frac{c^2}{3}$, and consequently its ($w$) (when $c = b$) $\sqrt{a^2 - b^2}$, and consequently $\dot{z} \left( = \sqrt{a^2 + b^2} \right) = \sqrt{a^2 - b^2}$; therefore, in this case, $\dot{w} = \frac{2 \pi a x}{y}$.
which being to \( \frac{2 \rho b c x}{aa} \times \sqrt{a^2 - x^2} \), the fluxion before found, in the constant ratio of \( 1 \) to \( \frac{2 \rho b c x}{a^2} \), their fluents must, therefore, be in the same ratio; and so the latter expressing the superficies \( C \times F \times D \), will conseqently be \( \frac{2 \rho b c x}{aa} \times B \times E \times F \times H = \frac{2 \rho}{a} \times \frac{FH}{HS} \times B \times E \times F \).

This solution, it may be observed, obtains only in case of an oblong spheroid, generated by the rotation of the ellipsis about its greater axis; for in an oblate spheroid, generated about the lesser axis, the value of \( \sqrt{a^2 - c^2} \) will be impossible; hence, in this case, \( H \times F \) is greater than \( H \times A \).

But if we, here, put \( b = \sqrt{a^2 - c^2} \), and \( d = \frac{a^2}{b} \), the value \( \tilde{s} \) (found above) will become \( \frac{2 \rho b c x}{a^4} \sqrt{a^2 + x^2} \).

\[
\sqrt{a^2 + x^2} = \frac{2 \rho b c x}{d^2} \times \frac{d x}{d^2} \times \sqrt{a^2 + x^2};
\]

whence the following may be brought out by the help of a table of logarithms: for, let the variable part \( \sqrt{d^2 + x^2} \) be transformed to \( \left( \frac{\sqrt{d^2 + x^2}}{\sqrt{d^2 + x^2}} = \frac{d^2 + x^2}{d^2 + x^2} = \frac{d^2 x^2 + x^2}{d^2 x^2 + x^2} = \right) \frac{1}{\sqrt{d^2 x^2 + x^2}} + \frac{1}{\sqrt{d^2 x^2 + x^2}} \), so that the numerator of the form \( \frac{\sqrt{d^2 x^2 + x^2}}{\sqrt{d^2 x^2 + x^2}} \) (now in a given ratio to the fluxion of the quantity under the radical sign) may be had by the common rule; by which means we get \( \frac{1}{\sqrt{d^2 x^2 + x^2}} \), for the true fluent of the said term; to which adding the fluent of the other term \( \frac{1}{\sqrt{d^2 x^2 + x^2}} \), or \( \frac{\sqrt{d^2 x^2 + x^2}}{\sqrt{d^2 x^2 + x^2}} \), there arises \( \frac{1}{\sqrt{d^2 x^2 + x^2}} + \frac{1}{\sqrt{d^2 x^2 + x^2}} \times \text{hyp. log.} \) \( x + \sqrt{d^2 + x^2} \), for the fluent of \( \sqrt{d^2 + x^2} \); and this corrected and multiplied by \( \frac{2 \rho c x}{d} \) gives \( \frac{2 \rho c x}{d} \times \sqrt{d^2 + x^2} + \text{hyp. log.} \) \( x + \sqrt{d^2 + x^2} \), for the superficies in this case, where the proposed spheroid is an oblate one. Simpson's Fluxions, vol. i. p. 187, &c.

Superiorities, Line of, a line usually found on the sectar, and Gunter's scale. The description and use of this, see under Sectar and Gunter's Scale.

Superiorities of the Earth, Internal, a term used by Tull, and others, to express that part of the earth which affords the pabulum, or what is called the 

The internal superficies of the earth, which is the pasture of plants, is not like the external surface, which is the pasture of animals, in that it cannot be enlarged without the addition of more surface taken from land adjoining to it, by enlarging its bounds or limits; but the internal superficies, or artificial pasture of land, may be enlarged without addition, or more land, only by division of the same earth; and this artificial pasture may be increased in proportion to the division of the parts of the earth, of which it is the superficies.

The "cube of earth of one foot" has but six square feet of superficies, but divide this cube into cubical inches, and then its superficies will be increased twelve times, that is, it will be forty-two superficial feet. Divide these cubes into such others, as bear the same proportion to inch that an inch does to a foot; and then the same quantity of earth, which had at first only six feet superficies, will have a superficies of eight hundred and sixty-four feet of natural pasture; and in the same manner is the foil divided, and consequently this pasture increasable ad infinitum.

Poor land does not afford an internal superficies to well stocked with these fruitful particles as rich land does, but this we may compensate by dividing it more, and then what it wants in quality may be made up in quantity.
SUP

The common method of dividing the foil is by dung, or by tillage, or by both; and none of the natural pastures is ever lost, or injured by the use of the artificial means, but, on the contrary, it is meared by such means, a free communication being made by them between pore and pore. Tull's Horaeoing Husbandry, p. 18.

SUPERFINE, in the Manufactory, a term used to express the superfine fineness of a stuff. Thus a cloth, camblet, &c. are said to be superfine, when made of the finest wool, &c., or when they are the finest that can be made.

The term is particularly used, among gold wire-drawers, for the gold or silver wire, which, after being drawn through an infinite number of holes, each less and less, is at length brought to be no bigger than a hair.

SUPERFLUOUS INTERVAL, in Music, is one that exceeds a true diatonic interval by a femitonic minor. See INTERVAL. Thus the

Superfluous Second, or Tone, contains a femitonic minor more than a tone, in practice found, and will therefore be expressed by $\frac{5}{4} \times \frac{4}{4} = \frac{20}{16} = \frac{5}{4}$. The root of these expressions is a tone minor, and a femitonic minor; since $x \times \frac{5}{4} = \frac{5}{4} \times x$; and the other is a tone major, and femitonic minor; for $x \times \frac{4}{4} = \frac{4}{4}$. This last occurs in practice, and is one of the intervals of the chromaticum tonizium. See CHROMATIC and SECOND.

In the temperate scales these two superfine tones coincide. Thus from $B\flat$ to $C$ sharp, or from $F$ to $G$ sharpened, are superfine tones.

Superfluous Third is greater than the third minor by a femitonic minor, and will therefore be expressed by $\frac{5}{4} \times \frac{4}{4} = \frac{20}{16} = \frac{5}{4}$. It is not in use. It forms a fourth on our harphichords. Thus from $B\flat$ to $D$ sharp is properly speaking, a superfine third; but $D$ sharp and $E\flat$ being confounded, it fails for a fourth.

Superfluous Fourth. This interval is expressed by $\frac{5}{4} = \frac{5}{4} \times \frac{4}{4}$. It is by practitioners, and in temperate scales, confounded with the tritonus. See INTERVAL.

Superfluous Fifth is expressed by $\frac{5}{4} = \frac{5}{4} \times \frac{4}{4}$. This is equal to two thirds major, for $\frac{4}{4} \times \frac{4}{4} = \frac{4}{4}$. The superfine fifth occurs in the same way as from $C$ to $G$ sharpened.

Superfluous Sixth. This interval is of two kinds; being the respective complements of the two diminished thirds to the octave. One only, strictly speaking, answers to the general definition of a superfine interval, which is that interval which exceeds the fifth minor by a femitonic minor, and is therefore expressed by $\frac{5}{4} = \frac{5}{4} \times \frac{4}{4}$. But the other interval, which is a comma more than the former, and is two femitonic major less than the octave, is chiefly used in harmony, as between $B\flat$ and $A$, where it has a fine effect. It is expressed by $\frac{5}{4} = \frac{5}{4} \times \frac{4}{4} = \frac{20}{16} = \frac{5}{4}$. See INTERVAL and Diminished Third.

Superfluous Seventh is expressed by $\frac{5}{4} \times \frac{4}{4} = \frac{20}{16}$. This is a dissonant less than the octave. See INTERVAL.

Superfluous Octave is a femitonic minor more than the octave, as from $C$ to $E$ sharpened. It sometimes occurs in the basses of instrumental pieces.

SUPERINCESSION RABENS. See SILING.

SUPERINCESSION FOLIERS. See ROLLING.

SUPERINSTITUTION, SUPRINSTITUTION, denotes one upon another. As if A, be admitted and instituted to a benefice upon one title, and B, be admitted, instituted, &c. by the presentation of another.

SUPERINTENDENT, in the French Customs, an officer who has the prime management and direction of the finances or revenues of the king.

The term is also used for the first officer in the queen's household, who has the chief administration of it.

They have also a superintendent of the buildings, answering to the surveyor of the works among us.

The cardinal de Richelieu made himself superintendent of commerce.

Superintendent also denotes an ecclesiastical superior in several reformed churches where episcopacy is not admitted; particularly among the Lutherans in Germany, and the Calvinists in some other places.

The superintendent is, in effect, little other than a bishop; only his power is somewhat more restrained than that of our diocesan bishops.

He is the chief pastor, and has the direction of all the inferior pastors within his district or diocese.

In Germany they had formerly superintendents general, who were superior to the ordinary superintendents. These in reality were archbishops; but the dignity is sunk into dioceses; and at present, none but the superintendent of Wittenberg assumes the quality of superintendent general.

Superior, or Superior, something raised above another, or that has a right to command another. Thus an abbot is called the superior of an abbey, and a prior the superior of a convent.

The canonists hold, that a perpetual superiority constitutes a title; but a superior may be continued by those who constituted him such, yet without the superiority's being rendered by that means perpetual.

The church of France formerly allowed the superiority and primacy of the pope, and his infallibility to all the other Roman churches do. See PAPAL, AMBASSADOR, AND PRIEST.

Superior Auris, in Anatomy, a muscle of the external ear. See EAR.

Superior Oculus Retini et Obliqueus, two muscles of the eye. See EYE.

Superior Serratus Pectoralis. See SERRATUS.

Superior Courts of Record. See COURT.

Superior, Lake, or Upper Lake, so called from its northern situation, in Geography, the largest and most magnificent body of water on the continent of North America, and said to be the most extensive in the known world, being computed at 400 miles in length, and 1800 miles in circumference. According to Mackenzie, its greatest breadth is 120 miles, and its circumference, including the bays, 1300. The water of this lake is clear and pellucid, of great depth, and abounding with a great variety of fish, which are the most excellent of their kind. Here are troops of three kinds, weighing from five to fifty pounds,urgeon, perch, chub, pike, red and white carp, black bass, herrings, &c. &c. and the left and right of all, the "tiamang," or white fish, which weigh from four to sixteen pounds, and is of a superior quality in these waters. This lake may be denominated the grand resort of the river St. Lawrence. The principal rivers that discharge themselves into it are the St. Louis, the Nipigon, the Pic, and the Michipicoten. Although it receives ample supplies, it is said that not a tenth part of its waters pass off by the streams mentioned below. Hence it appears that by evaporation this large inland sea furnishes the interior parts of the country with vapours, without which they must, like the interior parts of Africa, be a desert. This lake, and also Michigan and Huron, form one large inland sea, which might be called the sea of Canada, or that of Huron; and this part of the said sea opens into the lake Huron by the straits of St. Mary, about 40 miles in length, and in some places only one or two in breadth,
breath, with a rapidity towards the N.W. extremity, which, however, may be defended by canoes. The prospects are here delightful. The forenoon on this large expanse of water are of less danger than those on the ocean, the waves breaking as suddenly, and running nearly as high. In this lake are several islands, one of which, called "Minong," or "Tile Royale," is about 100 miles in length, and in many places 40 broad: they are surrounded by the lavers or bays as residences of the Great Spirit. This vast collection of water, says Mackenzie, is often covered with fog, particularly when the wind is from the E., which drives against the high barren rocks on the N. and W. shore, diluting the air with torrents of rain. It is very generally said that the shores of this lake are denoted by a smell on the preceding day; but the phenomenon does not seem to be regular, as the smell often frequently suffocated without any subsequent wind. Along the surrounding rocks of this immense lake, evident marks appear or the decrease of its water, by the lines observable upon them. The interval, however, between the highest and the lowest is not to great as in the smaller lakes, as it does not amount to more than six feet, the former being very few. In the year 1658, when the six millionaires visited the south of this lake, they found the country full of inhabitants. About this time a band of the Nezinsauges, who were converted, are said to have emigrated to the Nipigon country, which lies to the N. of Lake Superior. Few of their descendants are now remaining, and not a trace of the religion communicated to them is to be discovered. The inhabitants now found along the coast of this water are all of the Algonquin nation, but in their whole amount they do not exceed 150 families. These people live chiefly on fish, the country, for want of shelter, affording few other animals. The rocks appear to have been overrun by fire, and the flinted timber, which once grew there, is frequently seen lying along their surface. Indeed, as there is little appearance of foil, vegetation to any great degree cannot be expected. Between the fallen trees there are briars, with gooseberry-bushes, raspberries, &c. which invite the bears in greater or less numbers, as they are a favourite of such animals. Beyond the rocky banks are found a few moose and fawn-deer. The waters alone are abundantly inhabited. The water at the Grand Portage, some years ago precipitately withdrew, the fall being equal to four perpendicular feet, and then rushed back with great velocity above the common mark. It continued thus falling and riling for several hours, gradually decreasing, till it settled at its usual height. Here is frequently an irregular flux and deflux, which does not exceed ten inches, and is attributed to the wind. The bottom of the bay, which forms an amphitheatre, is clear and inclosed; and on the left corner of it, beneath a hill, 500 or 400 feet in height, and crowned by others of a greater altitude, is the fort, pincered in with cedar palisades, and inclosing hovels constructed of wood, and covered with shingles. These are calculated for every convenience of trade, and the accommodation of the proprietors and clerks during their short residence there. The soil bordering on the lake has been favourable only to the cultivation of potatoes, which circumstance is ascribed to the cold damp foams of the lake, and the moisture of the ground from the springs that illude from beneath the hills. In the vicinity are meadows that yield abundance of hay for the cattle; but agriculture has not hitherto been an object of consideration. N. lat. 45° 4' to 48° 45'. W. long. 84° 40' to 91° 55'.

Superioris Labii Lectoris, in Anatomy, a muscle of the upper lip. See Delegation.

Superiority, in Agriculture, a fort of tenure, in some places, as in some parts of Scotland. It is that kind of tenure, or nominal fort of security is land, which the lord or superior had, in early times, given to a tenant upon him, and which still exists, in some degree, in some parts of the more northern districts of the island. The writer of the account of the State of the Agriculture of the County of Peebles states, that superiority is merely that nominal title to land, which confers the right of franchises. That as 400l valuation of superiority gives the right of franchises, and that as, in the above county, superiority may be retained, when the property of the land is conveyed away, and that this superiority may also be feebly conveyed in any given portions, it is evident that, in creating votes, the superiority of the whole valuation, 51,927l. Scots, would, if paid, give one hundred and twenty-nine voters at the county election; as, however, the number commonly upon the roll of freethinkers does not exceed thirty or thirty-five, it may be readily inferred, that the county has not been much disturbed by the anomalies of political contest.

Such forts of nominal tenure should, however, now be done away; since circumstances have so much changed the nature of property in land.

Superiority, in Mufs., in early days of counterpart, signified the treble or half height part.

Superlativic, in Grammar, an inflexion of noun adjective, serving to augment and heighten their signification, and shew the quality of the thing denoted to be the highest degree.

In English, the superlativic is usually formed by the addition of of, as richest, holiest, &c. rarely by the addition of siffus, as generalissimo; more frequently by the prefix of, as most honourable, most amiable, &c.

The French are generally forced to form their superlatives by prefixing of le plus, sometimes of tres, and sometimes of fort.

The Italians and Spaniards have great advantages over them in this respect; their language abounding with magnificent words, for exaggerating things with auxiliary particles; yet the Hebrews are more poor than the French in this respect, as having neither comparatives, nor superlatives. They express these degrees by the particles and, and that; sometimes by the preposition bin, and sometimes by redoubling the word; of which we find frequent instances in the Bible.

Superana, in Hindoo Mythology, is a name of great celebrity in the legends of the East, usually employed to carry the person of the god Vishnu. The Hindoo deities have different animals assigned as their vehicles, when journeying. These are called in Sanskrit vamas, or vaham; which see. One of the commonest names of Superana is Garuda, sometimes pronounced Gauro, by which a large species of falcons, well known in all parts of India, is also once had. The English usual style is the Brahmany kite; it being held in veneration by many Hindoos, who very much dislike having it killed. In this there is utility, as well as superstition; for the bird in question is very useful, in concert with the vulture, in devouring carrion, and performing the office of scavenger. It is well when
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when superstitition promotes, as is not unfrequent, the purposes of utility.

The mythological Garuda is seen variously portrayed in pictures, as a man with the beak and wings of an eagle, painted red, green, or blue. He is also frequently seen in carvings, and is sculptured in the cavern temple at Elephanta, with Vihnu, seated fire-walking, rather ridiculously in our eyes, on his shoulders; Garuda holding by both hands on Vihnu’s ankles. Wherever he appears in this cave, his projecting nose or beak has been broken off, as it is said, and with reason, by the iconoclastic fury of the Portuguese, while Bombay and its contiguous islands, including that called by us Elephanta, were in their possession; a bigotry to be regretted in a thousand instances, and no where more than in Elephanta cave, which still exhibits, though sadly defaced, some of the most extraordinary and curious sculptures in existence.

Garuda is a very important personage in Hindoo mythology; and his birth, life, and exploits, are constantly referred to in Hindoo writings. One of the Puranas is called, after him, Garuda Purana, and contains his history. Vihnu being the sun, Garuda seems, as his apparent vehicle, and in some points of family and character, to be a personification of the sky. His younger brother is named Aruna, and is the driver or precurser of the glorious car of Surya, or the sun; hence corresponding perhaps with the Aurora, or dawn, of western fable; as well as carrying Vihnu, and his comfort Lakshmi. Garuda is seen also flying through the air with Rama and Sita, and sometimes with Kriiti, on his back. But there are representations by feasters of these several gods, who, each adoring the incarnation as the deity, array the object of their adoration in the attributes of the archetype. See Krishna, and Sects of Hindus.

Garuda is a fabled to have married a beautiful woman: her name or parentage does not occur to our recollection, nor in our memoranda. The tribe of serpents, alarmed at this marriage, left the offspring thereof inherit the propensities of the fire, waged fierce war against him; but he destroyed them all, save one, which he placed in an ornament about his neck. In several parts of the Elephanta cave, Garuda is seen with this appendage; and on very ancient Hindoo coins and medals, he has snakes and elephants in his talons and beaks: for he is sometimes spread and double-headed, like the eagle of Propheta. A legend connected with the parentage and exploits of the hero of this article is noticed under our article Kusa. Garuda had a son of some note, named Sumabha; and a daughter of surpassing beauty, named Su-mati, who was espoused by Sagara, or the sea. When we recollect the furnishes that Garuda, or Sumeru, as the vehicle of Vihnu, a type of the aqueous element, is a personification of the sky or visible firmament, we may discover some connexion in the allegory of an alliance between his descendant and the sea. The beautiful maiden, (the meaning of her name, Su-mati, which see,) thus allied, became wonderfully prolific; the brought forth (if the Hindoo romantic language be rightly construed) a gourd, whence ensued 60,000 male children.

The author of the Hindoo Pantheon, in his account of Garuda, notices the extensive prevalence of serpentine forms in the mythological machinery of Egypt and Greece, as well as in India. In many instances, the bird of Jove is brought to our minds by the fables related of this Indian eagle. The story of Prometheus is also found to have a near relation to some of them.

SUPERNATANT Part of the Ship, that part which, when afloat, is above the water.

SUPERNATURAL Grace. See Grace.

SUPERNATURAL theoP. See Theology.

SUPERNUMERARY, in the latter times of the Roman empire, soldiers added to the legions after it was completed. These were the same with those in former times called Accensi.

SUPERNUMERARY, something over and above a fixed number. In several of the offices are supernumerary clerks, to be ready on extraordinary occasions.

There are also supernumerary surveyors of the excise, to be ready to supply vacancies, when they fall: these have but half-pay.

SUPERNUMERARY, in Ancient Music. Proslambanomenos, the lowest found in the Greek scales, said to have been added by Pythagoras to complete the octave, was termed supernumerary, as it implies additional, or addition. It answers to Ars, the second note in the first hexachord of the Guido scale, who still added another note, Gambut, to the Greek scale.

SUPERNUMERARY Bones of the Head. Anatomists distinguish this appendage several bony pieces found in some skulls, chiefly between the parietal and occipital bones. They form breaks in the lamboidal future, and are joined by the futures to the bones already mentioned.

Their figure, number, and size, vary extremely: sometimes they are triangular, or approaching to that form, but oftener they are of no determinate figure: in some subjects they incroach on the occipital bone, and in others on the parietal bones; and sometimes they extend themselves in every way. They are commonly indented, and broader on the outside of the skull than on the inside, in which they have no visible indentations; and sometimes, when they are small on the outside, are hardly at all to be seen within. They have by some been termed keys, a name used by joiners for the pieces which serve to strengthen the joints of boards; but this can agree to them only in respect to their situation, not in respect to their uses with regard to the other bones of the head. Some such bones have also been found in the joints, between the bones of the head and face; and between those of the bones of the face with each other. Winflow. See Cranium.

SUPERONERATIONE Pastule. See Surcharge.

SUPERPARTICULAR. See Ratio.

Ptolemy, in his Harmonics, seems to lay a great stress on superparticular ratios, beyond the superpartient in music. He does not call the intervals which may be expressed by the former ratios, excepting 2 : 3 and 3 : 4, dissonants, as the Pythagoreans did, but consonants, as if they were of a middle nature between consonant and dissonant. But all the doctrine of superparticular ratios is a precarious hypothesis. The two thirds, major and minor, expressed by 5 : 4 and 6 : 5, are superparticular, and concords. Their octaves, 5 : 2 and 12 : 5, are superparticular, and concords also. Ptolemy also refutes the Pythagoreans for excluding the diapason dissonant, expressed by 8 : 3, from the number of concords, because its proportions were superpartient; yet his own doctrine is equally precarious. Vide Euler, Tentam. Nov. Theor. Music. p. 65, 64.

SUPERPARTIENT RATIO. See Ratio.

SUPER-PREROGATIVA Ratis, a writ which formerly lay against the king’s widow for marrying without the suitor’s licence.

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SUPERPURGATION, Hypercatharsis, in Medicina, an excessive, over-violent purging.

SUPERQUADRIPARTITIUS. See Ratio.

SUPER-SALTUS, in Chymistry, faits with an excess of acid, as super-tartrate of potash. See SALTUS.

SUPER-GAUPLARIS, Superior and Inferior, in Anatomy, old names for the muscles of the fascia, commonly known under the terms supera or infra, spina; which see.

SUPERSEDEAS, in Law, a writ suffused in divers cases, importing, in general, a command to stay or forbear some ordinary proceedings in law, which, in appearance, ought to be done, or purged, were it not for the cause on which this writ is granted.

Thus, a man regularly is to have a surety of peace against him of whom he will swear he is afraid; and the justice required hereunto cannot deny it him; yet, if the party be formally bound to the peace, either in chancery, or elsewhere, this writ lies to stay the justice from doing that, which otherwise he ought not to deny.

SUPERSEDEAS, Clerk of the. See Clerk.

SUPERSEDEAS, a Commission of Bankrupt. If such a commission ifues, and there is sufficient to pay all the creditors, and the charges, and satisfaction is made to all the creditors, the commission may be superseded. A commission is also sometimes superseded, when the creditors agree with the bankrupt, and consent to a supersedeas.

SUPER-STATUTO, 1 Ed. III. c. 12, 13, is a writ that lay against the king's tenants holding in chief, who aliened the king's land without his licence.

SUPER-STATUTO de articulis Cleri, cap. 6, a writ lying against the sheriff, or other officers, that distrains in the king's highway, or in the lands anciently belonging to the church.

SUPER-STATUTO facta pour Sanechial & Marshal de Roy, &c. a writ that lies against the warder or marshal for holding plea in his court, or for trespasses or contracts not made, and arising within the king's household.

SUPER-STATUTO versus Servantes et Laboratores, a writ which lies against him who keeps any servants, departed out of the service of another contrary to law.

SUPERSTITION, extravagant devotion, or religion wrongly directed, or conducted.

Superstitition consists in false and abject notions of the Deity, in the gloomy and groundless fear of invisible beings, and in the absurd rites which these notions and fears naturally produce; and, generally speaking, it is the effect of ignorance, or of a judgment perverted by a four and splanetic temper.

The author of the article Fanaticism in the Diction. Encyclopaedia, Paris, defines fanaticism as a blind and passionate zeal, which arises from superstitious opinions, and leads its votaries to commit ridiculous, unjust, and cruel actions, not only without shame, but even with certain internal feelings of joy and comfort; from which he concludes that fanaticism is really nothing more than superstitition fret in motion.

The difference between true religion and superstition seems to be this: that the former is the exercise of the understanding and affections, and the regulation of the conduct, founded on just notions of God, and of the method of averting his displeasure and securing his favour; and the latter is the result of fancy and passion un directed and un governed, and originating either in the delusive hope of pleasing God by some opinion or practice entirely distinct from, and contrary to, those notions, or the diftressing fear that he will not be pleased with the addition of something which such notions neither require nor justify.

Superstition, says Dr. Hartley (Obl. on Man. p. 290.), may be defined a mistaken opinion, concerning the severity and punishments of God, magnifying these in respect of ourselves or others. It may arise from a sense of guilt, from bodily indisposition, from erroneous reasoning, &c. That which arises from the first cause, has a tendency to remove itself by regulating the person's behaviour, and consequently lessening his sense of guilt; the other kinds often increase for a time, come to their height at last, and then decline again. They do also, in some causes, increase without limits during life. All kinds of superstition have been productive of great absurdities in divine worship, both among Pagans, as well as Jews and Christians; and they have all a great tendency to form the mind, to check natural benevolence and compassion, and to generate a bitter persecuting spirit. These effects are much augmented, where superstition and enthusiasm pass alternately into each other at intervals, which is no uncommon case.

Superstition has been often used, especially by the ancients, for an excess of religion, agreeably to that verse of Aulus Gellius, lib. iv. cap. 9.

"Religentem effe operoet; religiosem nefas."

It was a piece of superstition in the ancient Romans, to observe the flight of birds, the entrails of victual, &c. It has been observed by some excellent critics, that the Greek word ἡσυχασμος, which occurs in the New Testament, though it is often used in a bad sense, has also a good, or at least an innocent, meaning. Accordingly they think that it should be rendered religious, and not superstition, in Acts, xxv. 19., alleging, that it cannot be supposed Feltus would speak contemptuously to Agrrippa of the Jewish, that is, of Agrippa's own religion, when Agrippa was come to Cesare, with his filter Berenice, to him, Thus also it is apprehended that the word ἡσυχασμος, Acts, xxv. 23., should be translated devout, or exceedingly addicted to the worship of invisible powers, and not too superstitious. The word in the former sense, it is urged, would give no offence at Athens; it was the peculiar character of the Athenians, and conveyed an encomium which they were fond of above any other. The latter harsh sense of the word is inconsistent with the whole design of St. Paul's argument. Lard. Cred. vol. i. p. 489. note s. Duddr. in loc.

Monti. Thiers has an express treatise "Des superstitious populaires." Women, he observes, are naturally more inclined to superstition than impiety. Plutarch has endeavoured to shew, that superstition is worse than atheism. The punishment allotted, by several councils, for the superstitious, is, to fast a month in prison.

SUPERSTITIOUS MAGIC. See Magic.

SUPERSTITIOUS Usus, in Law. See Mortmain.

SUPER-SULPHATE of Potash. See SALT.

SUPERVISOR signifies a surveyor or overseer; it was formerly, and still remains, a custom among some, especially of the better sort, to make a supervisor of wills, to overlook the execution, and fee their wills truly performed: but it is little purpose, as being now so carefully executed.

SUPINATION, in Anatomy, that motion of the upper extremity, by which the palm of the hand and the corresponding surface of the fore-arm are turned upwards or forwards. See Extremities.

SUPINATOR, the name of two muscles of the fore-arm, which have the effect of bringing that part and the hand into the supine attitude.

The supinator radii longus (humero-fus-radialis) is a narrow but
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but very elongated muscle, placed superficially on the anterior part of the radial edge of the fore-arm, and extending from the inferior part of the humerus to the carpal end of the radius. It is flattened laterally in its upper fourth, and transversely in the lower three-fourths. Its anterior side is covered by the fascia of the fore-arm and the skin; the posterior is fixed above to the external ridge of the humerus, while it covers, below the suspensory brevis, the extensor carpi radialis longus, the pronator teres, the flexor carpi radialis, flexor digitorum sublimis, flexor longus pollicis, the radial artery and nerve. The outer side is unattached, and offers nothing remarkable; the inner covers the brachialis internus, and the radial nerve above, and has no particular relations of importance below. The upper extremity of this muscle is thin and pointed; and attached to the outer edge of the humerus below the passage of the radial nerve. Thence the muscle descends, at first a little obliquely forwards, and afterwards straight, or in a line parallel to the radius. The thickness and breadth increase as far as the elbow, from which they decrease again to the inferior extremity. The latter is attached to the anterior edge of the lower end of the radius at the base of its styloid process. The suspensory longus arises by short aponeurotic fibres from the humerus and the inter-muscular aponeuroses; its slightly fibrous tendinous, below in a thick flattened tendon, which forms about the lower third of the muscle. It will bring the radius and hand either from the flat pronation or supination, and pass into the middle between these attitudes; and then will it bend the elbow joint.

SUPINATOR RADII BREVIS (epi-condylo-radial), is a short flattened muscle, with curved fibres, placed at the outer part of the fore-arm near the elbow, where it closely surrounds the head of the radius, extending from the back of the external condyle of the humerus, and the neighbouring outer edge of the ulna, to the anterior part of the radius. The external surface is convex, and covered towards the front by the pronator teres, the radial artery and nerve, and the suspensory longus. The middle of the muscle is covered by the extensors radialis; and the back part by the extensor digitorum communis, extensor carpi ulnaris, and anconeus. The internal surface covers the capsule and external lateral ligament of the elbow, and adheres closely to these parts; it is then inserted in the upper third of the posterior and external surfaces of the radius. The posterior edge is attached to the external condyle, and to a longitudinal ridge of the ulna. The anterior is fixed to the radius, at the root of the occipital tuberosity, and for about two inches farther on the bone, terminating where the tendon of the pronator teres commands its insertion. This anterior edge is partly covered by the pronator teres. The attachment to the condyle and the ulna takes place by means of a strong tendon: the muscular fibres arising from this bend spirally round the head of the radius, passing from above downwards, and from behind forwards to the radius, in which they are implanted. The suspensory brevis rotates the radius on its axis, so as to turn the hand supinum; it will then extend the elbow.

SUPINE, in the Latin Grammar, a part of the conjugation of verbs, to indicate either the infinitive mood.

There are two kinds of supines: the one in um, whose signification is active, and marks a motion, as dare nupsum; the other in u, having a passive signification, as hordrem cadit, &c. The supines have neither number nor person.

They have their name, says Probus; and after him Volus, quod ad infar fupinorum et tesisforum bominum omnium habet confusa; or, according to Priscian, quod nuptatur a participio passivorum, quae supina appellata est; quis in primo loco sit, totum conjugationis modum suffizient.

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SUPINO, in Geography, a town of Naples, in the county of Molise, formerly the see of a bishop, removed to Boiano; 13 miles S.S.E. of Molise.

SUPITZBACH, a river of Saxony, which runs into the Elbe, near Torgau.

SUPOUR, a town of Hindoostan, in Allahabad; 27 miles E.S. of Ghazipore.

SUPPING, in Rural Economy, a term applied to the beverage afforded to servants, labourers, and cottagers, by the dairies in some districts, such as whey, milkings, and butter-milk, which is given to them instead of being converted to the use of pigs, as is usually the case, by which some lofs may probably be sustained by the farmer.

SUPPLANTALIA, or SUPP Ramp, among Physicians, plasters, or other medicaments, applied to the soles of the feet; generally made of leaven, mustard, horse-radish, falls soap, gunpowder, &c.

SUPPLE. To supple a horse in the manage, is to make him bend his neck, shoulders, and sides, and to render all the parts of his body more pliable.

SUPPLEMENT of an Arc, in Geometry, or Trigonometry, is the number of degrees that it wants of being an entire semicircle: as complement signifies what an arc wants of being a quadrant.

SUPPLEMENT, in Matters of Literature, an appendage to a book, to supply what is wanting in it.

Freinhenius has written divers supplements, to restore the blemishes of several antiquities, and to remove which had been lost. The French have also used the word supplement for a kind of tax, or after-payment, charged on lands, offices, &c. that are pretended to have been sold beneath their value.

SUPPLEMENTAL BILL, in Law. See Suit in Equity.

SUPPLETORY OATH. When there is only one witness (the civil law universally requiring the testimony of two) to make up the necessary complement of two, the civil courts admit the party himself (plaintiff or defendant) to be examined in his own behalf; and administer to him what is called the suppletory oath; and if his evidence happens to be in his own favour, this immediately converts the half proof into a whole one. Blackst. Com. vol. iii.

SUPPLICATION, SUPPLICATIO, in Antiquity, a religious solemnity observed on account of some remarkable successes against an enemy; and especially when the army had conferred the title of imperator on their general, in whose name the senate ordered the temples to be opened for the reception of the people, and thanks to be rendered to the gods.

On such an occasion the emperor sent messengers crowned with laurel with letters to the senate, which were likewise adorned with laurel, to demand of them the title of imperator, and the honour of a supplication. This solemnity consisted in sacrificing and feasting in the temples, with giving thanks to the gods for successes obtained, and praying for the continuance of their affluence. At first there were only a few days taken up in such festivals; but afterwards they were increased gradually, till they came to no less than fifty. On subduing the Sabines, in the year of the city 305, a solemnization of one day only was ordained; on the taking of Veii, Camillus had a supplication of four days decreed him; Pompey had twelve on putting an end to the Mithraic war; Caesar had fifteen, and afterwards twenty, for reducing Gaul; Octavianus and Pansa had fifty days of supplication for delivering the colony of Mutina.

SUPPLICAVIT, in Law, a writ, influing out of the court of king's bench, or chancery, for taking surety of the peace when one is in danger of being hurt in his body by another.
It is directed to the justice of the peace, and sheriff of the county; and is grounded on the statute 1 Ed. III. which appoints, that certain persons shall be assigned by the lord chancellor to take care of the peace. See Good-keeping.

SUPPLIES, called also aids and subventions, are extraordinary grants made by the commons of Great Britain, in parliament assembled; who, when they have voted a supply to his majesty, and settled the quantum of that supply, usually resolve themselves into what is called a committee of ways and means, to consider of the means and means of raising the supply so voted. And in this committee every member (though it is looked upon as the peculiar province of the chancellor of the exchequer) may propound such schemes of taxation as he thinks will be least detrimental to the public. The resolutions of this committee (when approved by a vote of the house) are in general esteemed to be (as it were) final and conclusive. For though the supply cannot be actually raised upon the subject till directed by an act of the whole parliament, yet no man may say he will not subscribe to the advancement of the government in case of ready cash, on the credit of the whole house of commons, though no law be yet passed to establish it; and which requires the assent of the other two branches of the legislature. The general reason given for this exclusive privilege of the house of commons, is that the supplies are raised upon the body of the people, and, therefore, it is proper that they alone should have the right of taxing themselves. This reason, says judge Blackstone, would be unanswerable, if the commons taxed none but themselves; but it is notorious, that a very large share of property is in the house of lords, which is equally taxed with the property of the commons; and, therefore, he says, the commons not being the sole persons taxed, this cannot be the reason of their having the sole right of raising and modelling the supply. The true reason, arising from the spirit of our constitution, he apprehends to be this. The lords being a permanent hereditary body, created at pleasure by the king, are suppos'd more liable to be influenced by the crown, and with less influence to continue so, more than the commons, who are a temporary elective body, freely nominated by the people. It would, therefore, be extremely dangerous to give the lords any power of framing new taxes for the subject. It is sufficient that they have a power of rejecting, if they think the commons too lavish or improvident in their grants. See PARLIAMENT and MONEY-BILLS. Blacklt. Com. vol. i.

SUPPLY, in Sea Language, a fresh recruit of provisions or stores sent to a ship or fleet.

SUPPLY and Consumption of Agricultural Produce, the quantity of this sort of produce which is necessary for the supply and consumption of the country by its population, and in some other ways connected with it, in a greater or less degree. It is a subject which is obviously involved in much difficulty, and on which, any calculations that may be offered to the public, can only be supposed to approximate, in some measure, towards the actual truth. At several different periods and times, calculations have however been furnished by different individuals on this very interesting matter; and those which have more lately been brought forward by the able calculator and writer of the Corrected Account of the Agriculture of the County of Middlesex, so far as they go, seem the most deserving of attention, not only as entering more fully into the business, but as laying down more data for proceeding upon, than any others which have fallen under our notice and examination.

The writer begins by stating, on the authority of the parliamentary reports, that the excess of the imports over the exports of corn, shows clearly, that the annual consumption of this country in that article has been greater than its produce, on an average of five years, ending at Christmas 1794, by quarters of

Wheat and flour - - - - - - - - - 184,821
Barley and malt - - - - - - - - - 66,445
Oats and oatmeal - - - - - - - - - 83,681
Rye - - - - - - - - - - - - - - - 36,799
Pease and beans - - - - - - - - - 41,848

The whole of the annual average imports exceeded the exports by

1,145,584

And that the same for five years, ending at Christmas 1799, was

Wheat and flour - - - - - - - - - 469,956
Barley and malt - - - - - - - - - 33,831
Oats and oatmeal - - - - - - - - - 618,041
Rye - - - - - - - - - - - - - - - 44,199
Pease and beans - - - - - - - - - 23,777

The whole of the annual average imports exceeded the exports by

1,191,131

The average of the said ten years was an annual deficiency of 1,168,361 qrs. of grain; to which, if we add that of the year 1800, which amounted to 2,269,344 qrs. of corn, we shall discover, it is said, that the average of the eleven years was annually 1,268,452. This quantity is equal to the broad-corn of nearly as many persons, or to the entire produce of (in acres of land) - 413,000

Proportion of fallow, one-fourth of the land - 105,500
Clover and root crops ditto - 105,500
Land to support the requisite number of labouring cattle to till the deficiency of arable, and to produce food, both in corn and hay, for their own support; one horse to every 20 acres, and allowing them to require four acres each, is in acres - 136,000
Hedge-rows, site of buildings, yards, roads, ponds, gravel-pits, &c. Together - 790,000
Allow for inferiority of quality between commons and old inclosures; one-fifth of 790,000 is 158,000; but say only - 150,000

1,010,000

The average quantity and price of all sorts of grain may be found thus:

<table>
<thead>
<tr>
<th>Acres.</th>
<th>Qrs.</th>
<th>Qrs.</th>
<th>L.</th>
<th>s.</th>
<th>d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2 3/4</td>
<td>2 2/3</td>
<td>5 1/2</td>
<td>46</td>
<td>13</td>
</tr>
<tr>
<td>Barley and rye</td>
<td>5/2</td>
<td>3</td>
<td>2 3/4</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>Oats and beans</td>
<td>2 3/4</td>
<td>4</td>
<td>10</td>
<td>21</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>17 2/3</td>
<td>26</td>
<td>10</td>
</tr>
</tbody>
</table>

Dividing 17 2/3 qrs. by 6 acres, gives a bare 3 qrs. per acre; and dividing 26l. 10s. 6d. by 17 2/3 qrs. gives a bare 30s. per quarter, that is, 3 qrs. at 30s. is a full average of the corn, exclusive of the straw, feed, and walking. The proportion which the number of acres bears in each fort of grain, will be seen below.
SUPPLY.

It is further noticed, that the whole deficiency during the said 11 years, was not less annually than all that could be grown by cultivating our commons, to the extent of 1,000,000 acres. The miserable consequence of which was, that, notwithstanding we imported food from any country where it could be obtained, the death became so great as to occasion the death of about 100,000 inhabitants. The present system of passing local acts, every session of parliament, for enclosing a few thousand acres of waste land, is altogether, it is thought, unequal to the task of warding off the return of death, or to keep down the price of provisions; owing to human beings increasing in a much greater proportion than such additional cultivation.

It is also said, that Mr. Claud Scott, the most eminent corn merchant that perhaps ever lived, laid an account before a committee of the house of lords early in the year 1797, by which it appeared, that for three years, ending the 5th of January in that year, there were paid to foreign nations for grain imported into this kingdom the following sums; namely,

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1794</td>
<td>£1,963,856</td>
</tr>
<tr>
<td>1795</td>
<td>£1,592,672</td>
</tr>
<tr>
<td>1796</td>
<td>£3,926,840</td>
</tr>
</tbody>
</table>

In the three years was paid £7,446,012

Average annually £2,482,000

The writer's opinion therefore, he says, perfectly accords with the language of lord Carrington, who, on quitting the chair of the Board of Agriculture, in March 1803, said, "if, after the experience of more than 20,000,000Sterling having been sent to foreign countries for the purchase of grain, within the short period of a very few years, the legislature still can condemn millions of acres, which are capable of every kind of produce, to remain obnoxious to the little that can be of infatuation."

After this statement, the ingenious writer and calculator attempts to estimate the quantity of land in South Britain, or what is commonly called England and Wales, which is occupied with each sort of field crops; the probable number of horses and sheep, which are kept and made use of; the quantity of animal food; and the various other products of the soil which are raised, together with the weight and value of wool; and the total amount of all sorts of agricultural produce.

It is said, that the returns then lately made to parliament prove, that there were about 9,000,000 of inhabitants in the above extent of South Britain; and that the best opinion appears to be, that all those who eat wheat bread, consume annually eight Winchester bushels of wheat; which include puddings, pies, confectionary, and every other application of wheat in the article of food. This quantity of wheat is about equal, it is thought, to the average produce of half an acre of land; that is, after deducting feed, loss by vermin, accidents, &c. from the gross produce, the remaining net quantity is 76 bushels per acre.

That those persons who eat bread made from spring-corn and rye, will in like manner require the net product of half an acre; as the flour of this sort of grain is so much deficient in quantity, weight, and nourishment, as fully to balance the greater number of bushels per acre in the produce; therefore, as half an acre supplies bread for one person, it is said, that

1st. Nine million inhabitants consume the corn which grows on

2dly. Beer.—A family of six persons, of all ages, requires 24 bushels of malt annually; which, at the usual proportion of nine to eight, is rather more than three bushels and a half of barley to each person; but as there are many who do not drink malt liquor at all, this would be too large an allowance for all England and Wales: therefore it may be estimated at three bushels each, which, for the whole population, is 27,000,000 bushels, or 5,375,000 quarters of barley; and that, at the average crop of three quarters per acre, after allowing four for feed, &c. is, in acres

Distilleries.—In the whole of Great Britain, rather upwards of 500,000 quarters of barley are, it is said, used in this manufactory, which, divided by 3, reduces them into 165,000 acres; from that number deduct 15,000 for Scotland, and the remainder for England and Wales is about

Beer and spirits exported, the produce of

Starch, hair-powder, and other manufactures

Corn consumed by oxen, sheep, hogs, poultry, rabbits, &c. the produce of

Horses consume, it is said, corn to the amount of the produce of from one and a half to three acres each, or on the average two acres.

Arable land employs about one horse to every 15 acres, which on 15,000,000

Grass land employs one horse to every 100 acres, which, on 20,000,000, is

Number of horses used in agriculture

Horses kept for pleasure, and taxed

Post-chaise horses, mail-coach horses, stage-coach horses, hackney-coach horses, &c. supposed to be about

Horses used in waggon and cart, in mills, canals, and navigable rivers, in caravans, and for all the other purposes of draught, not before described

Cavalry of all the various descriptions

Number of horses not used in agriculture proper

Total number of horses

Carry forward

3 2

5,920,000
SUPPLY.

Which, at two acres each, will consume the produce of arable land
Land cropped with turnips, carrots, parsnips, cabbages, and potatoes, coriander-feed for the brewers, and

dragglets, canary-feeds for birds, and with dyers', physical and culinary herbs; cultivated by the
plough
Clovers, rye-grasfs, &c. one year's lay, in the proportion of one-tenth
Fallow, in the proportion of two-tenths

The consumption of the country requires, in aration,
But we import corn, proportionate to the produce, of upwards of

Which, deducted from the foregoing number, leaves the quantity of arable land in South Britain, rather under

* This estimate would seem to be too low by nearly one-third or fourth, or probably more.

It is said, that in order to discover the quantity of land cropped with each species of grain, the writer adopts the following hypothesis, founded on his own observations, made in most of the counties in England, namely, that, including the common arable fields, six-tenths of all the arable land in South Britain is cultivated under the old system of wheat, spring-corn, fallow: three-tenths are in something like the rotation of wheat, turnips, spring-corn, clover; and the remaining one-tenth is in a course of oats, roots, clover.

First position, 6-10ths divided by 3, gives us for
fallow 2, wheat 2, oats and beans 2, together

Second position, 3-10ths divided by 3, gives us that the wheat is 0.75, the barley and rye 0.75,
the roots 0.75, and the clover 0.75, together

Third position, 1-10th divided by 3, produces for oats and beans 0.5, roots 0.25, and clover 0.25, together

General proportion, fallow 2, wheat 2 7/5, oats
and beans 2 5/7, barley and rye 0.75, roots 1,
clover 1, together

According to this statement, it is concluded that every 10,000,000 acres of arable land, are cropped in the following proportions; namely,

<table>
<thead>
<tr>
<th>Grain</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2,750,000</td>
</tr>
<tr>
<td>Oats and beans</td>
<td>2,500,000</td>
</tr>
<tr>
<td>Barley and rye</td>
<td>750,000</td>
</tr>
<tr>
<td>Roots</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Clover</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Fallow</td>
<td>2,000,000</td>
</tr>
</tbody>
</table>

Total 10,000,000

By which also it appears, it is said, that the corn-crops, including beans, are in the proportion of fix to ten; the green crops in that of two to ten; and the fallow, of two to ten.

It is noticed, that having before shewn, that there is at most 15,000,000 acres of land in aration in South Britain, it is only necessary to increase the said numbers one-half, and the produce will shew, that the soil of England and Wales is annually cropped with the following quantities of each kind of grain, &c: thus,

<table>
<thead>
<tr>
<th>Grain</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>4,125,000</td>
</tr>
<tr>
<td>Barley and rye</td>
<td>1,125,000</td>
</tr>
<tr>
<td>Oats and beans</td>
<td>3,750,000</td>
</tr>
</tbody>
</table>

Carry forward 9,000,000

* This estimate would seem to be a good deal too high, as perhaps one-third or fourth, or more.

Brought forward 15,000,000

Clover, rye-grafls, &c. one year's lay
Turnips and other roots, as aforesaid,
The arable land, producing at least one crop annually, is
Fallow, as aforesaid,

Together 15,000,000

Hop-grounds.—The produce of the two years 1772 and 1773, was, it is said, nearly 8000 tons annually; therefore we may call that the consumption at that period. The next clearing year was 1787, being a period of 14 years; and the average produce of the 14 years was 8937½ tons, and there never was remembered a greater scarcity than at the coming in of the growth of 1788, so that the consumption from September 1774, to September 1788, must have increased from 8000 tons to 9875 tons, otherwise the average product of 8937½ tons could not have been confirmed. The average produce of 13 years, ending with the year 1800, has been 9668 tons; therefore the consumption in this latter period must have decreased 209 tons, and they are now much more on the decline, as drugs are used for the purpose of curing beer, in lieu of hops.

Nursery grounds about 10,000
Fruit and kitchen gardens cultivated by the spade 50,000
Pleasure-grounds, the drested and unprofitable parts only; the rest being either pastured by cattle, or mown for hay; plantations, belts, and clumps 35,000
Land depastured by cattle; lays of more than one year; meadow of natural grasses, meadow of fawn grasses, and water-meadow and orchards on grafsland, which includes the cider counties * 20,000,000

This quantity of grafs-land, it is said, includes parks, paddocks, and pleasure-grounds, whether mown for hay, or grazed by cattle.

Carry forward 35,120,000

* This estimate would seem to be a good deal too high, as perhaps one-third or fourth, or more.
SUPPLY.

Brought forward—

Hedge-rows, copses, and woods—
Ways, waters, and yards, the sites of cities,
towns, villages, and other buildings—

Total in England and Wales—

Horse-food equivalent to 1,800,000 horses, 
each, is—
Fallows—
Ways, waters, buildings, &c. —
Pleasure-grounds—
Manufactories, vermin, damp, mufti, &c. —
Nursey-grounds—
Hedge-rows, copses, woods—
Druggists' physical herbs, roots, &c. —

Commons—

Together—

| Acre. | £
|-------|-------
| 35,120,000 | 1,980,000 |
| 2,000,000 | 39,100,000 |
| 1,980,000 | 7,816,000 |
| 46,916,000 | 22,121,000 |

which taken from 46,916,000 acres, the quantity of land in England and Wales, leaves 24,795,000, whereof the produce is consumed by human beings, in the proportion of 2½ acres each. By attending to the preceding part of this account, it will appear that it is divided in the following proportions; namely, for bread, half an acre; for liquids, one-eighth of an acre; for animal food, near two acres; and for roots, greens, and fruit, &c. one-eighth of an acre.

No peron will, it is supposed, expect any of these quantities to be mathematically true, or correct; particularly as we have no maps of England that can be depended on, for the purpose of ascertaining the quantity of land, not even, perhaps, nearer than eight in ten of the actual quantity. This fort of calculation is only meant to furnish the mind with some general ideas respecting England and Wales.

Animal Food.—There are, it is said, annually sold at Smithfield market, about 100,000 bullocks, and 700,000 sheep. There are many also sold at several of the towns and large villages near the metropolis, of which no account is taken, perhaps equal to the supply of Southwark, and all the places out of this county that lie within five or ten miles of town; consequently the inhabitants of this county consume nearly as much animal food as is sold at Smithfield.

For Middlesex, 100,000 beasts, at 100 ft. of 8 lbs. each, is—
700,000 sheep, at 10 ft. each, is—
Lams 24, calves 24, hogs and pigs 2, together—
Poultry, game, and fish, ¼ lbs.; dairy, ¼ lls;—

Total—

| Stone. | £
|-------|-------
| 10,000,000 | 4,350,000 |
| 7,000,000 | 2,100,000 |
| 7,000,000 | 330,000 |
| 1,100,000 | 6,680,000 |

which divided amongst 818,129 inhabitants, is 30 ft. 5 lbs. or 24½ lbs., which cost upwards of 8½. 5s. each person.

For England and Wales 1,000,000 bullocks, at 90 ft. each, is—
9,000,000 sheep, at 9 ft. each—
Lams 8, calves 8, swine, fish, poultry, game and dairy, 24; together—

Total—

| Stone. | £
|-------|-------
| 90,000,000 | 81,000,000 |
| 40,000,000 | 211,000,000 |

which, at 4½. 6d. a stone (offal included in the price, but not in the weight), amounts to 47,145,000ls. sterling per annum; which being divided among 9,000,000 of inhabitants, is 23 ft. 3½ lbs. or 187½ lbs.; and being priced in the same manner, amounts to 5½. 5s. 5d. per head, the meat nearly to 3 lb. 10 oz. per week for each person.

Wool and Mutton.—It is stated that it was given in evidence, on passing the last wool bill, that the clip of England and Wales amounted annually to about 600,000 packs, of 240 lbs. each, or 144,000,000 lbs., which fell at 10d. per pound, and produce 6,000,000l. sterling. That the mills and machinery employed in the woollen manufactory are supposed to have cost 6,000,000l. sterling, and the manufactured goods produced from the wool are said to be worth 18,000,000l. whereas are exported annually to the amount of 6,000,000l. The average yield of each sheep is taken to be a small fraction more than 4 lbs., by which divide the whole quantity of wool, and it will be seen that we have of stock sheep 35,000,000. It is apprehended that they consist nearly of

12,000,000 breeding ewes, which bring as many lambs. The former are killed off at an average of five years old, or annually—
25,000,000 other sheep, which are killed off at an average of three years, or annually—
35,000,000 Total number of sheep. Of which are killed annually—

Lams slaughtered—
Lams and sheep die in, from the rot, one in twenty-five of the last two numbers—
Yearly increase and decrease—

The mutton, taken at 9 ft. per sheep, and the lambs at 5 ft. gives 100,000,000 ft. as the yearly consumption.

Annual
SUPPLY.

Annual Produce of the Agricultural Capital of England and Wales.—This is stated as follows:

<table>
<thead>
<tr>
<th>Acres</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,000,000 of arable land in crop annually, at 5l. is</td>
<td>60,000,000</td>
</tr>
<tr>
<td>35,000 of hop-ground, at 5l. is</td>
<td>1,500,000</td>
</tr>
<tr>
<td>10,000 of nurseries, at 5l. to 100l. say at only 50l. is</td>
<td>50,000</td>
</tr>
<tr>
<td>50,000 of garden-ground cultivated by the spade at from 50l. to 100l. say at only 60l. is</td>
<td>3,000,000</td>
</tr>
<tr>
<td>25,000 of unprofitable pleasure-grounds, which cost a quarter of a million in labour, and return nothing.</td>
<td></td>
</tr>
<tr>
<td>20,000,000 of grass-land, at 3l. is</td>
<td>60,000,000</td>
</tr>
<tr>
<td>7,816,000 of commons</td>
<td>1,000,000</td>
</tr>
<tr>
<td>2,000,000 of woods, copses, and hedge-rows, at 10l.</td>
<td>1,000,000</td>
</tr>
<tr>
<td>1,980,000 of ways, water, and buildings, nothing.</td>
<td></td>
</tr>
<tr>
<td>3,000,000 fallow.</td>
<td></td>
</tr>
<tr>
<td><strong>46,916,000</strong> the whole quantity of land, the produce of which is</td>
<td><strong>126,690,000</strong></td>
</tr>
<tr>
<td>Which costs in labour, artificers, and horse-keep</td>
<td><strong>56,690,000</strong></td>
</tr>
<tr>
<td><strong>Remains net increase in value on the produce of the land per annum</strong></td>
<td><strong>70,000,000</strong></td>
</tr>
<tr>
<td>Of which, it is said, the landlords take</td>
<td><strong>42,000,000</strong></td>
</tr>
<tr>
<td>The State, in taxes and tithes</td>
<td><strong>13,000,000</strong></td>
</tr>
<tr>
<td>And the farmers are permitted to share the remaining</td>
<td><strong>15,000,000</strong></td>
</tr>
<tr>
<td>which is all they receive in return for interest of capital, skill, industry, and attention.</td>
<td></td>
</tr>
</tbody>
</table>

* It is noticed, that this part of the account might be varied, by stating the amount of animal food at 40,000,000. 

The wool, as | 6,000,000 |

The tallow, skin, bones, &c. | 10,000,000 |

Fed by horses, &c. | 5,000,000 |

The produce of animals | 61,000,000 which is the same amount as above.

It is noticed in conclusion on this, that if the manufacturing and commercial parts of Great Britain were to be tried by this rule, namely, of sharing less than one-fourth part of their real gains, as appears to be the case with the agricultural branch of the community, they could not exist an hour under what they would term such severe oppression.

But as the increase of the population of South Britain, since the above calculation was made, is supposed to be about one million, it will be necessary to add a tenth to the above number of acres, which will give the amount which is required for the supply and consumption of the present time, and makes the whole

And although the quantities of land which are taken up by each foot of crops; the number of horses and sheep which are made use of and kept, or the amount of animal food and other products of the land, and wool-bearing animals, with the whole of the agricultural produce, as above, of the other different parts of the kingdom, known under the names of Scotland and Ireland, cannot be well ascertained and calculated for want of sufficient grounds and data to proceed upon, (though they may probably approach those of the first part or division in some degree) yet the supply and consumption of their population may be thrown, when estimated on the same principles as the above, to require as below.

<table>
<thead>
<tr>
<th>Acres</th>
<th>£</th>
</tr>
</thead>
<tbody>
<tr>
<td>27,274,500</td>
<td>Brought forward 27,274,500</td>
</tr>
</tbody>
</table>

The former having, it is supposed, a population of 1,805,000, will, for its supply and support, stand in need of about the produce of | 4,975,000 |

The latter, as containing, it is believed, a population of about 5,500,000, will demand for their supply and consumption the produce of | 15,150,000 |

These two being added to the quantity requisite for the supply and consumption of the first part of the kingdom, will give the amount of the acres which are necessary for supplying the whole of the population of the united kingdom with this sort of produce, which are | 47,400,000 |

As, however, the supply and consumption in these last cases may be somewhat less abundant than in the other, the number of acres here stated may perhaps be rather too large.

The number of cultivated acres of land necessary for the supply, subsistence, and support of the population of the united kingdom being thus extensive, every endeavour should be made to keep up with it as much as possible, by the better and more perfect culture of those lands which are already in that state, and by promoting the enclosure and cultivation of those in the condition of waste, as by those and other suitable means, an almost unlimited increase of agricultural produce may be drawn from the earth, and the nation be ultimately rendered independent of foreign supply.

Supply.
SUPPLY'S Passage, in Geography, a channel of the South Pacific ocean, between Sirius island and Queen Charlotte's island, so named by Lieut. Ball, who commanded the Supply shore-ship, in 1792.

SUPPORTED, in Heraldry, a term applied to the uppermost quarter of a shield, when divided into several quarters; these seeming, as it were, supported or sustained by those below.

The chief is also said to be supported when it is of two colours, and the upper colour takes up two-thirds of it: in this case it is supported by the colour underneath.

SUPPORTERS, figures standing on the scroll, and placed by the side of the escutcheon, and seeming to support or hold up the same. SUPPORTERS are, chiefly, figures of beasts: figures of human creatures, used for the like purpose, are more properly called tenants.

Some make another difference between tenant and supporter: when the shield is borne by a single animal, it is called tenant; when by two, they are called supporters.

The figures of things inanimate, sometimes placed aside of escutcheons, but not touching or seeming to bear them, though sometimes called supporters, are more properly called colts.

Supporters have formerly been taken from such animals as are borne in the shields; and sometimes they have been chosen as bearing some allusion to the names of those whose arms they are made to support. F. Menefriar traces their origin to the ancient tournaments, in which the knights caused their shields to be carried by servants or pages under the disguise of lions, bears, griffins, blackamoors, who also held and guarded the escutcheons, which the knights were obliged to expose to public view some time before the lists were opened. But Sir G. Mackenzie says, that the first origin and use of them are derived from the custom of leading such as are invested with any great honour, to the prince who confers it, and of his being supported by two of the quality, when he receives the symbols of such honour: and in remembrance of that solemnity, his arms were afterwards supported by any two creatures which he chose.

The supporters of the English arms are a lion, and an unicorn; some of the former kings have had a leopard, and an unicorn; others, griffins; others, eagles. See Arms.

The supporters of the French arms are angels; which are said to have been first introduced by Philip VI., his device being an angel overthrowing a dragon, the dragon being, at that time, the device of the kings of England.

Those of the prince of Monaco are Augustine monks; those of the family of the Ursini, bears; in allusion to their names.

In England, supporters are the prerogative, first, of those called nobles majores, viz. dukes, marquises, earls, viscounts, and barons; secondly, of all knights of the garter, though they should be under the degree of barons; thirdly, of knights of the Bath, who both receive on their creation a grant of supporters: and lastly, of such knights as the king chooses to honor in this manner. Supporters are not hereditary, except to the elder branches of some knights of the garter, whose ancestors had this honour granted them; and to the eldest sons of peers above the degree of a baron, who bear their father's arms and supporters, with a label, &c. See Crown.

The Germans permit none but princes and noblemen of rank to bear them: among the French, the use of them is more prominent.

Supporters, in Ship-Building, are the knees placed under the catheads, for their security and support. They formerly partook of the curve of the middle rail of the head, but lately the arm at the side stands plumb, or perpendicular.

SUPPOSTITIOUS BIRTHS. See Bastards.

SUPPOSITORY, a preparation of salt, honey, &c. which is introduced into the rectum, in order to procure it. Medicinal compositions are also thus applied, with a view of driving out local diseases of the bowels.

SUPPRESSION, formed from sub and prono, I press under, in Law, the extinction or annihilation of an office, right, rent, or the like.

SUPPRESSION, in Grammar, denotes an omission of certain words in a sentence, which yet are necessary to a full and perfect construction. As, "I come from my father's;" that is, "from my father's house.

Suppression is a figure of speech very frequent in our language; chiefly used for brevity and elegance. Some rules relating to it are as follow:

1. Whenever a word comes to be repeated in a sentence oftener than once, it is to be suppressed. Thus we say, "This is my master's horse," not, "This horse is my master's horse."

2. Words that are necessarily implied may be suppressed.

And, 3. All words that use and custom suppress in other languages, are to be suppressed in English; unless there be particular reasons to the contrary.

SUPPRESSION, in Medicine, is applied to the humours that are retained in the body by some obstruction or stoppage of the usual outlet.

We
SUPP

We lay, a suppuration of urine, of the menesfs, &c. See ISCHURIA, URINE, MENSES, &c.

SUPPRESSION of Urine. There are commemorated in the Philosophical Transactions three cases of an actual and total suppuration of urine, supposing to proceed from a stone lodged in the neck of the bladder; but in all which, on introducing the catheter, it was found that there was no stone there, nor any urine in the bladder. In all these cases the same remedy was used; that is, a great quantity of acid diluted largely with water, and in conformance of this, the urinary secretion was immediately restored, and the patient soon voided it in a proper manner, and was restored to health without any further use of medicines. Philos. Trans. No 253.

A suppuration of urine sometimes happens to women with child, by the womb falling down, and preffing on the urethra.

It is also occasioned by an inflammation of the bladder, a swelling of the hemorrhoidal veins, hard lumps formed in the rectum, a stone in the bladder, excrescences in the urethra, pain from a pain of the bladder, hysterical affections, &c., of which cases requires a particular treatment. It may be observed, in general, that in all of them, mild and gentle applications are the safest; as strong diuretic medicines, or things of an irritating nature, generally increase the danger. See Retention of Urine.

SUPPRESSION, Fire of, in Chemistry. See FIRE.

SUPPURATION, in Surgery, denotes the processes by which purulent matter is formed in cases of abscesses, ulcers, wounds, &c.

When, notwithstanding the means usually employed for the relief of inflammation, this affection becomes attended with more severe pain, a much harder tumefaction, and a conical prominence in its centre, suppuration is likely to ensue. When the patient is seized with reiterated shiverings; when the fever, and all the symptoms of inflammation, suddenly cease, without any perceptible reason; when the patient experiences a heavy, cold, dull uneasiness, instead of acute pain in the part affected; when the most elevated part of the tumour appears soft and white, while the red has its redness increased; and when, at the same time, the face changes from a livid to a blood-red, the suppuration of a fluid; matter is undoubtedly already formed.

We shall not here dwell upon the symptoms which attend suppuration, as they are considered in other surgical articles of this dictionary. See Abscesses, &c.

With respect to the theory of suppuration, it may be observed, that the exposure of the internal surfaces and structure of the body, continued for a certain time, necessarily occasions suppuration. Here the influence of the air is not the cause; for, were a wound to be made into a cavity naturally closed, pus would be formed after a certain time, even in a vacuum. When matter forms in circumcised cavities, without a wound, the air cannot be supposed as a cause; nor does the air, in emphysematous cavities, excite suppuration. The sympathetic fever, attendant on inflammation, has been considered an essential step to suppuration; but with little foundation. Is there not a regular secretion of pus from the most indolent ulcers? Is there not the same process on every blistered surface? In such cases, is there not oftentimes a total absence of fever? That dead animal matter cannot be converted into pus, is proved by the roughness of the cellular membrane, tendons, fasciae, &c. remaining unchanged a considerable time in abscesses, and by dead bone lying unaltered in pus for many months. Whatever diminution of these substances may happen under such circumstances, occurs only on that side which is next to the living solids; and it can be satisfactorily accounted for on the principle of absorption.

The idea, that fermentation contributes to the formation of pus, is quite defective of foundation. The discharge of pus from secreting surfaces, without any loss of substance; the stationary state of many abscesses; the backwardness of matter to become putrid, while unexposed to the air; sufficiently evince that no fermenting power is present.

The opinion, that extravasated blood may in time change into pus, is equally erroneous. When suppuration is about to take place in the cellular substance, or membranes of circumcised cavities, the vessels alter their mode of action, so as to make pus. The change happens gradually. Hence, pus and coagulating lymph are often found blended together in the same abscess.

The fact, that pus may be formed without a breach in the folds, or dilatation of parts, was first noticed by the celebrated Dr. William Hunter, in the year 1749 or 1750. The example of the breast of a fatted duck, who died of empyema. M. Quefniy has also alluded to, in the Memoirs of the French Academy of Surgery, which fell under the observation of M. Peyronie, in which there was a very copious suppuration of the brain. The patient died, and the head was examined. The propensities of brain wanting was so trivial, compared with the quantity of pus which had been produced, that Peyronie justly concluded, that the matter had not been formed from the blood, but from the fluids of the part. See Remarques sur la Plaisir du Cerveau, tom. ii. p. 165, edit. in 1808.

The modern doctrine of suppuration is, that the pus is separated from the blood by the inexplicable operation of the secreting arteries, just as ordinary secretion takes place; and that the peculiar mode of action in the arteries is the reason why pus should be separated from the circulation, rather than coagulating lymph, mucus, &c. It is further believed, that the fluids never suffer any dilatation, so as to enter into the composition of pus; but that the deficiency, frequently apparent in them, arises from absorption. The arteries, in producing pus, a fluid diffuse from blood, and of which the diffusible fluids of the blood, are looked upon, considered as a new combination, seem to assume all the power of glandular secretion. Cooper's First Lines of Surgery, chap. p. 53 edit.

SUPPURATIVES, or SUPPURATING Medicines, are ripeners, or medicines that promote suppuration.

Suppuratives are all hot; by which means, increasing the warmth of the part, they resolve the humour into a pus. Such are mallows, meillot, lily-roots, diaphyson, pelargon, figs, aromatic gums, meals, &c.

SUPPUTATION. See COMPUTATION.

SUPRA, in Myth. See EPI and HYPER.

SUPRACOSTALES, in Anatomy, the levatores costarum muscles. See INTERCOSTAL Muscles.

SUPRACOMPOSITE, in Botany and Vegetable Phystiology, is a term applied to a leaf, or a panicle, which is more than twice compound or subdivided. See Leaf, Inflorescence, and Panicula.

SUPRALAPSARIANS, in theology, persons who hold that God, without any regard to the good or evil works of men, has resolved, by an eternal decree, fut faciam, antecedently to any knowledge of the fall of Adam, and independently of it, to save some; and does others; or, in other words, that God intended to glorify his justice in the condemnation of some, as well as his mercy in the salvation.
Supremacy, in the *English Policy*, the superiority of the king over the Church of England, as well as of the state of England, of which he is established head. See *King*.

The king’s supremacy was first established by the Church, or, as others say, recovered, by king Henry VIII. in 1534, after breaking with the pope. *Stat. 24 Hen. VIII. c. 12. 25 Hen. VIII. c. 21. 26 Hen. VIII. c. 1. 35 Hen. VIII. c. 3. 1 Ed. VI. c. 12. 1 Eliz. c. 1. It is since confirmed by several canons, as well as by the articles of the church of England; and is passed into an oath, which is required as a necessary qualification for all offices and employments, both in church and state; from persons to be ordained, from the members of both houses of parliament, &c. See *Oath and Coronation Oath*.

The oath was finally established by 1 W. c. 8. as Vol. XXXIV.
plain, before Alexander joined it to the shore by a mole, very manifest, since it is plain that the sea, by covering this mole while land, has enlarged it by successive accumulations, and formed the present isthmus. The village of Sour is situated at the junction of this isthmus with the ancient island, of which it does not cover above one-third. The point to the north is occupied by a bafoon, which was a port evidently formed by art, but is at present so chocked up that children pass it without being wet above the middle. The opening at the point is defended by two towers, opposite each other, between which formerly passed a chain fifty or sixty feet long, to shut the harbour. From these towers began the walls, which, after surrounding the bay enclosed the whole island: but at present we can only follow their traces by the foundations which run along the shore, except in the vicinity of the port, where the Motouallis made some repairs twenty years ago, but these are again fallen to decay.

Further on in the sea, to the north-west of the point, at the distance of about three hundred paces, is a ridge of rocks, which rise to the surface of the water. The space which separates them from the main land in front, forms a fort of road, where vessels may anchor with much safety than elsewhere; but a free from danger, for they are exposed to the north-west winds, and the bottom injures the cables. That part of the island which lies between the village and the sea, that is, the western side, is open; and this ground the inhabitants have laid out in gardens: but such is their sloth, that they contain far more weeds than useful plants. The southern side is rocky, and more covered with rubbish. The whole island contains only fifty or sixty poor families, which live but indifferently on the produce of their little grounds, and a trifling fisheries. The houses they own are no longer, as in the time of Strabo, edifices of three or four stories high, but wretched huts, ready to crumble to pieces. Formerly they were defended towards the land, but the Motouallis, who possessed themselves of this place in 1766, enclosed it with a wall of twenty feet height, which still subsists. The most remarkable building is a ruin at the south-east corner. This was a Christian church, built probably by the Crusaders; a part of the choir only is remaining: close to which, amid heaps of stones, lie two beautiful columns, which were found by a kind of chance in ruins, and Djezzar, who has stripped all this country to ornament his mosque at Acre, wished to carry them away, but his engineers were not able even to move them.

Leaving the village, on the side of the isthmus, at a hundred paces from the gate, we come to a ruined tower, in which is a well, where the women go to fetch water. This well is fifteen or sixteen feet deep; but the depth of the water is not more than two or three feet. Better water is not to be found upon the coast. From some unknown cause, it becomes troubled in September, and continues some days full of a reddish clay. This seasoan is observed as a kind of festival by the inhabitants, who then come in crowds to the well, and pour into it a bucket of sea-water, which, according to them, has the virtue of restoring the clearness of the spring. As we proceed along the isthmus, towards the continent, we perceive, at equal distances, the ruins of arcades, which lead in a right line to an eminence, the only one in the plain. This hill is not fictitious, like those of the desert, but a natural rock of about one hundred and fifty feet in circumference, by forty or fifty high; nothing is to be discovered above but ruins, and the tomb of a sultan or sultaness, remarkable for the white dome at the top. The distance of this rock from Sour is about a quarter of an hour's walk. As we approach it, the arcades become more numerous, and are not so high; they terminate by a considerable bend, and, at the foot of the rock, form suddenly a right angle to the plain, and proceed obliquely towards the sea: we may follow their direction for above an hour's walk at a horse's pace, till at length, we distinctly perceive, by the channel on the arched, that this is no other than an aqueduct. This channel is three feet wide, by two and a half deep; and is formed of cement harder than the stones themselves. At last we arrive at the well where it terminates, or rather from which it begins. This is what some travellers have called the well of Solomon, but, among the inhabitants of the country, it is known only by the name of Ras-el-Gen, or head of the spring. They reckon one principal, two lesser, and several small ones; the whole forming a piece of masonry which is neither of hewn nor rough stones, but of cement mixed with sea-pebbles. To the south, this stone-work rises about eighteen feet from the ground, and fifteen to the northward. On this side is a slope, wide and gradual enough to permit carts to ascend to the top, at which when we arrive we discover what is very surprising: for, instead of finding the water low, or no higher than the ground level, it reaches to the top; that is, to a height of more than thirty feet higher than the ground. Beyond this, the water is not calm, but bubbles up with violence, and rushes through channels contrived at the surface of the well. It is abundant as to drive three mills which are near it, and form a little rivulet before it reaches the sea, which is only four hundred paces distant. The mouth of the principal well is an octagon, each side of which is twenty-three feet three inches, the diameter, therefore, must be sixty-one feet. It has been said that this well has no bottom; but La Roche affirms that he found it at six and thirty fathoms. It is remarkable, that the motion of the water at the surface has corroded the interior lining of the well, so that its edge refts almost upon nothing, and forms a half arch, suspended over the water; among the channels which branch out from it, is a principal one, which joins that of the arches above-mentioned: by means of these arches, the water was formerly conveyed to the rock, and from the rock, by the isthmus, to the tower, whence the water was drawn. The adjacent country is a plain of about two leagues wide, far and nearly level; to the east it is crossed by a kind of marsh, which stretches from Kafmio to Cape Bianco. The soil is a black earth, on which a small quantity of corn and cotton are successfully cultivated.

Sour has now no other trade besides the exportation of a few sacks of corn and raw cotton, nor any merchant but a single Greek factor in the service of the French of Saide, who scarcely makes sufficient profit to maintain his family; 18 miles S.S.W. of Saide. N. lat. 35° 13'. E. long. 35° 13'. Volney's Travels in Egypt and Syria, vol. ii. For the history of ancient Tyre, see Tyre.

Sura. See Taor.

Sura, the name of a drink used in the East Indies, and made of the juice that flows from the cocoa-tree.

This juice being evaporated, and exposed to the sun, forms a sugar, but it is little esteemed.

Sura, in Anatomy, the calf of the leg.

Sura, in Geography, a town of Asia Minor, in the province of Dierbekir, on the Ephesates; 55 miles S. of Kaliahbe.—Alfo, a town of the Arabian Trak, on the Ephesates; 150 miles N. N.W. of Baffora. Alfo, a town of Ephesates, in Watermann, column 15; 15 miles N. of Stroemthas. Alfo, a river of Norway, in the province of Drombog, which runs into the North sea, opposite to Christianland.
SUR

—Alfoo, a river of Ruffia, which runs into the Volga, near Vefil, in the government of Ninigorod.

SURA, the name of a race of genii, or good angels, of whom mention is perpetually made in the mythological writings of the Hindoos. They are sometimes called Soor, or Soors, by European writers. Auroa, or Alfoo, is the name of a malevolent race, opposed to the Suras; the initial letter being changed in the Sanscrit tongue, and Sura meaning good. It seems to be a generic term, comprising several species of benevolent genii; such as Gandharvas, Kinnara, Dunhudi, Puhipha-vrihti, Sinara, Uparsa, &c, who appear to be celestial choristers, dancers, mountain nymphs, flower-flowers, nereids, &c. Among the Auras may be classed the Daitayas, (offspring of Diti and Kasyapa,) Raksha, Yaksha, Pitri, Danava, (offspring of Danu,) &c.

The Suras, it is suggested, are stars of the northern hemisphere, and the Auras of the southern. The Hindu writings abound in allusions to their state of continued warfare, and it seems probable, so prone are the Suras to physical as well as moral pertonification, that such fables are of an altronic nature, and relate to the rising and setting, and other phenomena, of stars in the two, or supposed light and dark, hemispheres.

Sura appears alfo to mean fermented liquors, or spirituous liquors, and Auroa such as reject them. This has not lutherho been explained. The first book of the Ramayana contains the well-known and popular allegory of chivalry in the ocean, so beautifully translated by Mr. Wilkins in that curious work the Bhagavat Gita. Among the precious things produced by this process was Sura, there said to be wine or Suraderi, goddess of wine. (See Suradevi.) Sura is likewise a name of Surya, the regent, or a personification of the sun. (See Surya.) Hence has arisen some apparent confusion in alluding to Sura the regency of both wine and wealth, and in regard to the latter, of intellectual wealth; for the Veda is represented to be the true wealth and wine of the devout. The word Sura, indeed, in Sanscrit, means both wine and wisdom, or intellectual wealth. The Veda abounds in praises of the sun, or as mystics say of the sun or soul, of the universe; or, in other words, of the Deity: but in these points we must refer to the articles Maya, Mystical Poetry, O'um, and Veda.

SURABHI, in Hindu Mythological Romances, is the name of an all-yielding cow, of whom many marvellous stories are related, and to which reference is frequently made in the writings and conviction of the Hindoos. Her origin is of course equally miraculous with her deeds. She is said to have arisen from the sea, when churned by the gods and demons, as related in our article Kurma-vatara; in which article reference is made to this, and in which a typographical error occurs, that we here take the opportunity of correcting. Speaking of Surabhi, for a "similarly beautiful," read "similarly bountiful." An instance of her bounty may be seen in our article Jamadagni. A Hindoo poet having occasion to mention the wealth or munificence of an individual of ancient days, is very likely to express this by saying, that "Indra had entrusted him with Surabhi, the cow yielding all that the heart can desire," as we find paid of the munificent prince Jamadagni. Indra, the regent of the firmament, is the supposed possessor of the boon-granting cow, and is hence, probably, called lord of wealth. See Indra.

Among a pastoral people, whose local food is of so much consequence, it is natural to expect that great regard will be paid to kine. A milch cow is in India an object of great importance and veneration. It is common for Brahman and others to feed a cow before they take their own breakfast, offering ejaculations of a pious and benevolent tendency.

The Hindoos hope to obtain the favour of the boon-granting cow, by shewing kindness to her offspring; and adoration of a cow is not uncommon, such as presenting flowers to her, washing her feet, &c. Travellers have noticed many instances of affectionate tenderness for cows and calves, on the parts especially of individuals of the feds of Brahmans and Bania. See Suṣra of Hindoos.

In marriage ceremonies, a cow, as a representative of Surabhi, the granter of desires, the emblem of fruitfulness, is one of the actors. The hospitable rites are concluded by letting loose a cow at the intersection of a gueft. A barber, who attends for that purpose, exclaims "The cow! the cow!" upon which the gueft pronounces this text: "Re- lease the cow from the fetters of Varuna. May the sabda my foe; may the deystray the enemies of both him (the host) and me. Dismise the cow, that the may eat grass and drink water." When the cow has been released, the gueft thus addresses her: "I have earnestly entreated this prudent perfon; saging, kill not the innocent harmless cow, who is mother of Rudras, daughter of Vafus, fifter of Adityas, the source of Urmita, or Ambrosia, &c." Mr. Cobilepko, in his "Eflay on the Religious Ceremonies of the Hindoos," A.R. Ref. vol. vii. remarks on the above passage, that "the guefts' intercession evidently imply a prayer, now become obsolete, of flaying a cow for the purposes of hospitality."

A cow, the reader will perceive, is no unimportant mythological personage; nor is the bull; the latter we have spoken of in another place, as the vehicle of the Hindoo god Siva, and the symbol of divine justice (See Siva.) These superstitions are not confined to India, though they probably originated there. Similar honours were paid to the symbollical bull by the Egyptians, as sufficiently noticed under our article Apis. In the Edda, too, some relations remind us of the Surabhi of the Brahmanas; for the northern nations strove a most proficuous cow, yielding rivers of milk from her teats, and legions of men from her body. See Edda.

The time is not, perhaps, very remote, when the original inhabitants of India had left abhorrence of killing kine than many sects now feel on that point. Ancient books profess the flaying of kine, as well as other animals. It must be allowed, however, that the very ancient code of laws called the Institutes of Menu, (See Menu,) lays down very severe penalties for flaying a cow, even without malice. These are in chap. xi. of that curious work, verfe 100 and following. The extreme utility of the cow and bullock in well-peopled and agricultural countries, will almost necessarily give rise to a repugnance at flaying them, which will, in no time, grow to stronger prohibitory feelings, and at length be flamed with the fanchion of holiness. Here we see, what we in many cases suppose, that mythology and religion inculcate principles grounded originally on the conveniences and wants of mankind. Of this, the reverence paid to the ichneumon hy the Egyptians is an example. (See Zeus.) And the sacredness of the falces, called by the English the Brahmany kites, in India, is another. See Superna.

SURACA, in Geography, a town of the island of Samos; 4 miles S.W. of Cora.

SURADEVI, in Hindu Mythology, is the name of the goddess of wine, or of strong drinks; but however often she may be sacrificed to, she is very rarely heard of, and her same rarely occurs in Hindu writings. Her origin...
from the sea, when churned by gods and demons to obtain certain precious articles, is noticed under our article Kurn-

mavatara. See also Sur.

SURADSJE, in Geography, a town of Arabia, in the
province of Yemen; 16 miles E.S.E. of Doran.

SURAES, or KURJAN SURAES, a name given in
Perfia to buildings constructed for the accommodation of
travellers. They are more commodious than the "choulties"
on the Coromandel coast, containing a variety of apartments.
They generally form a square, with a range of rooms on
each side, behind which are sometimes excellent stables.
It is customary for the muleteers to collect all the dirt which
has been made, and on his leaving the furnace, to set it on
fire, so that the stables are kept tolerably clean.

SURAJABAD, in Geography, a town of Bengal; 16
miles S. of Dacca.

SURAJEESIJUNN, a town of Hindooftan, in the cir
car of Elichpour; 12 miles W. of Elichpour.

SURAJPOUR, a town of Hindooftan, in Oude, on
the Gogra; 17 miles S. of Gooracour.-Allo, a town in
the circur of Schaurinpur; 25 miles S. of Merat.-Allo,
a town in Oude; 15 miles E. of Corah.-Allo, a town of
Oude, on the Ganges; 25 miles N.N.W. of Furruckabab.

SURAJPUTTY, a town of Hindooftan, in Bahar;
15 miles W. of Durbunngah.

SURAJGURAH, a town of Hindooftan, in Bahar;
15 miles S.W. of Mangbir.

SURALES MUSCULI, in Anatomy, the gastrocnemius
and soleus, which make up the chief bulk of the calf.

SURA, in Geography, a town of the principality of
Georgia, on the frontiers of Imiretta, anciently a city of
Colchis, and called Surium by Pliny; 50 miles W.N.W.
of Telif.

SURAMI, a town and fortress of Georgia, in the
province of Carduel; 24 miles W.S.W. of Gori.

SURAN, a town of Perfia, in the province of Khorasan;
45 miles N. of Maras.-Allo, a river of Perfia, which runs
into the Vatka; 32 miles N.E. of Slobozskoi, in the go-

derno of Viatka.-Allo, a town of Hungary, formerly
strong, but now defenced; 4 miles N.E. of Neuheuvel.

SURANUH, in Mythology, the wife of Surya, the
Hindoo Phoebus, a regent of the sun. She is fabled as
the daughter of Twiskha, the engineer of the gods, who is
found to correspond in many points with the Vulcan of the
Greeks. See Twashta, and Surya.

SURA, in Geography, a town of Austrian Poland; 15
miles N. of Lublin.

SURAT, a city of Hindooftan, in the province of
Gusserat, situated in a large and fertile plain on the left or
south bank of a considerable river, named "Tappi,"
which fee. It is encircled by two brick walls, that divide
it into the inner and outer town. The inner wall, which
is much decayed, is about two hours' walk in circumference,
and the outerwall, which is in tolerable good condition,
and which incloses both the inner town and the suburbs,
requires almost three hours to walk round it. The citadel
stands within the inner wall, on the inner side of the Tappi, and
is divided by trenches from the town. The outer wall is
within about twelve feet, and without more than twenty
feet high, and seven or eight feet in thicknees, and which,
at the height of eight feet, is reduced to about half its
thicknees, for the construction of a parapet to accommodate
those who defend the wall with small arms, the upper part
serving as a breast-work, and having loop-holes, through
which are fired the fuljets. It is, as Stavirinus says, almost
the only defence which the place possesses; the semi-circular
bastions butting out from the walls, and planted with a few
cannon, and the bulwarks, or foonces, projecting from the
wall, and placed at intervals round the town, at the distance
of five or six hundred feet from each, contribute little to the
security of the town; that, however, should be excepted
which is situated near the Naffry-gate, and which the
English have caused to be rebuilt in a stronger manner.
The inner town has twelve gates, two towards the river, and
ten towards the country; and opposite to these there is a
many in the outer wall. One of the gates, leading to the
river, and situated just below the castle, is called the
"Chiap-gate," because all the goods imported and ex-
ported must be carried through this gate, in order that the
custums may not be defrauded. Close to the inner wall are
several high and narrow spires, round which are balconies,
called by the Turks minarets, and serving for the purport
of calling the Mahometan to prayer. Although Surat has
been long under the dominion of the Mahometan Mogul,
it has no handsome mosque with towers, such as often occur
among the Turks and Arabians. The space included be-
tween the two walls has few houses, as it is chiefly covered by
gardens, which are extensive, by tracts of arable land, and
numerous lime and brick-kills. Few good houset are ten
either in the inner towns or the suburbs; but spite is
made of bamboo and plastered with mud, often occur.
If one division or ward, indeed, leading to the Delhi-gate, there
stands a building, which have a tolerably handsome
appearance. The larger houset are flat-roofed, and have
 courto before them; but the houset of the common people
are high-roofed. The squares of the city are spacious;
but the streets are, in general, unpaved, narrow, and ir-
regular, with projecting corners and shops. In dry weather
the dust of the unpaved streets is insufferable; and in the
rainy season they are very dirty, and much neglected
point of cleanliness by the native inhabitants, who throw
every kind of filth into the middle of the road, and fellon
or ever remove the accumulating dung-hills. Each street
has its own gates, which are shut up in times of turbulence;
and thefe, says Niebuhr, are as frequent here as at Cairo.
The principal edifice belonging to the city is the citadel or
castle, which was erected by the Mogul, on the corner of
Gusserat. It is a strong building, constructed of hewn
stone, and well provided with artillery. It has been
improved, with regard to strength and defence, by the English.
The court, or palace, where the nabob resides, is called the
"Durbar;" it lies to the S.W., about 200 paces from the
castle. The mint, where the silver which is imported is
 coined into rupees, is a large pile of buildings, surrounded
by a high wall. The lodges, or factories, of foreign nations,
especially the Portuguese, French, English, and Dutch,
are situated in the inner town; and each have what they call
a sharif in the suburb. Surat has two caravanseras, but it
had formerly a greater number, which were liberally sup-
ported. Its mosques scarcely deserve to be mentioned.
Its bazaars, or market-places, are numerous, and much
 frequented; and it has also a great number of retail shops.
The "Meidan," called the Cattle-gram, on account of the
proximity to the castle, is a large open plain. S. of the
castle, where both the Dutch and English companies have
large tents, or awnings, surrounded by palings of bamboo.
The bales of piece-goods are lodged here till they are
chipped and shipped off; and at a small distance is a
"latty," or warehouse, hastily constructed of wood, and
closet with mats of palm-leaves, in which private goods
were formerly houset.

At Surat provisions are plentiful and cheap; but though
it is built on the banks of a river, the inhabitants would
want water, that of the river before the town being al-

brackish,
brackish; if this inconvenience were not remedied by a number of deep wells, lined with brick, from which water is brought by oxen in leathern bags. Notwithstanding the warmth of the climate, the air of this city is wholesome. Fahrenheit’s thermometer has been observed at 98° in the month of March, while the wind blew from the N.; and at Bombay, 25° farther to the S., it snowed, in the month of May, at 93°.

The trade of Surat finds obstructions from the harbours, which lie too far out to enter, before the Tapshee is full of sand-banks. In the dry season the river is too low; and in that of the rains, it swells too suddenly, so as to overflow all the neighbourhood. If the river were confined by dikes, the stream, which, during the rains, often rises twenty-eight feet above its ordinary level, would carry away all the sand, and thus clearing the channel, would admit of the access of ships to the walls. But the despotic governments of Afla are impediments to all improvements for the general good.

General toleration and unqualified liberty are here granted to persons of all religious professions; and its inhabitants are accordingly very numerous. The Europeans residing here estimate the population of the city at a million of souls. Others have not allowed them to be much more than half this number; and Niebuhr is of opinion that this calculation exceeds the truth by two-thirds.

It is a curious circumstance, that though Surat furnishes no hospital for human beings, it has an extensive establishment of this nature for sick or maimed animals. When the Europeans turn out an old horse, or any other domestic animal, to perish as useless, the Indians voluntarily assume the care of it, and place it in this house, which is full of infirm, decrepit cows, sheep, rabbits, hens, pigeons, &c. Niebuhr says, that he saw there a blind and helpless tortoise, of a large size, which was reported to be 125 years old. The charitable Indians keep a physician on purpose for these animals. This hospital is said to contain 25 acres in extent; and its revenues amounted yearly to 6,000 rupees.

The country round Surat is very fertile, and so industrious are the inhabitants, that a piece of uncultivated ground is rarely to be seen any spot that does not yield some useful production. The soil is a reddish clay, and is seldom manured; except that they sometimes burn the dry stubble or refuse of the fields, the ashes of which serve, in some measure, to supply the wants of other manure. The cow and horse dung is either used for fuel, or for other purposes. The chief productions of the fields are wheat, nolis, or a grain serving the purpose of rice, and growing in bundles like maize; rice, allo a shrub, yielding a fruit from which is expressed an oil that is used for lamps, and the stalks of which, rolled in water, and separated into threads, serve for flax and hemp, and also tobacco. The chief article of trade which this country affords is cotton-cloth, and chiefly coarse and coloured cottons. No forests are met with in the vicinity of Surat; but besides the low and small underwood, there occasionally occur large shady trees, many of which are esteemed holy by the Goentoos, and under the shade of which they therefore build their pagodas or temples. Culinary vegetables are plentiful here. Beef is good and fat, and so are mutton and venison; but poultry are scarce. Butter and milk are good, and not very dear. Of wild animals, the tiger is, besides snakes, the only one to be feared. The houres swarm with bugs.

In surveying the vicinity of Surat, we must not omit the gardens, which are the property either of Europeans or of natives of the country. The finest of these is that belonging to the Dutch East India company, which presents a rich and charming aspect. The garden, formed by a late nabob, at the expense of 500,000 rupees, is very extensive; but laid out without much taste. Among the buildings of this garden is one of uncommonly large dimensions, having bath and fountains, and ornamented with Indian magnificence. The other buildings are harem for the nabob’s wives, entirely separate from each other, in each of which is one good apartment, the others being narrow chambers appropriated to the slaves. The passages from one suite of rooms to another, are so narrow, so winding, so blocked up by doors, as to afford a striking instance of the difficulty with which the unfortunate great in despotic countries regard all about them. The burial-places of the Dutch and of the Portuguese are situated in the suburbs. In the former, there is scarcely a tomb without lofty spires, and the meanest has a grave-flone with a sculptured epitaph. These burial-places are surrounded by a high wall, and covered, as Stavorinus estimates them, 100 roods of ground. The burying-place of the English is without the suburb walls. The principal inhabitants of Surat are Mahometans, and mostly strangers, although employed in the service of the government. They are as zealous in the observance of their law, as the Turks and Arabians. Although of the sect of the Sunnites, they tolerate the Shiites, and even permit them to celebrate the festival of Hassen. They make no scruple of drinking wine publicly, or of lending money upon interest. All people of distinction in Surat, and through the rest of India, speak and write the Persian language. Hence has this language been received at the courts, and the knowledge of it is very useful for the dispatch of business. In trade, corrupt Portuguese is the language used; and this is in India what the Lingua Franca is in the Levant. The Mussulmans of Surat bring about them many fakers of their own religion from the interior parts of the country. (See FAIR.) The Hindoos, the aboriginal inhabitants of the country, compose the most considerable part of the population of Surat. They are almost all of the cast of the Banians; and hence their skill and dexterity in matters of calculation and economy often raise them to places of considerable trust, in the collection of the taxes and customs for the Mahometans. These Banians, being born to trade, have engrossed the commerce of India to such a degree, that all foreign nations are obliged to employ them as brokers; in which employment they give better satisfaction than the Jews in Turkey. Europeans have never found reason to repent the entrusting even of their whole fortune to the Banians, who continue to give astonishing proofs of their probity and fidelity. Some of them are very rich, but all live in a style of moderate simplicity, wearing for drees only a plain robe of white cotton. At Surat are numbers of Percees, or Perians, who are skillful merchants, industrious artisans, and good servants. (See Parsees.) The same city are also Armenians, Georgians, and Jews, but not in considerable numbers. The Indian Catholics, commonly called Portuguese, from their speaking the Indian dialect of the Portuguese language, are numerous. The principal disorders to which the inhabitants are subject, are burning fevers, and the dysentery. Few of the natives of the country attain to any very advanced age. At Surat, the day is reckoned from funet to funet, and is divided, not into twenty-four hours, but into sixty gannes. Here are no clocks: the progress of the day is measured by different means. In a conspicuous situation, a man stands to put a cup of copper, pierced with a hole in the bottom, from time to time under water; every time the cup sinks, a garri is counted, and the man announces its lapse, by striking the number which it makes upon a plate of metal, that sounds like
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like a clock. Each garri consists of 24 of our minutes.
In the bouses of the great too, where clocks and watches are not wanting, this old fashion of measuring time is still kept up.

The coins current at Surat are those of gold, silver, and copper. The gold coin of the country is the mahur (which see.) The silver rupee is the standard coin. (See Rupee.) The only copper coin is the pice (which see.) Almonds are also paid to pass for money at Surat, which are brought from Persia, and they are called "badams." The comparative value, at the lowest medium of exchange, is variable: sometimes 60p. bitter almonds have been the current rate of a pice. No other money is current here; all foreign coins being taken according to their weight and affray. The weights are very various here, and are regulated according to the nature of the commodities to be weighed. The maund is the general standard weight. (See Maund.) The yard, as a measure of length, is known to the natives by the same name as in England, and with them is one gia, and 8 teefoo, the gia being 24 teefoo: the standard gia of Surat is 1 1/4 Dutch ell. Distances are reckoned by cada (which see.) The carriages most common here, as well as in other parts of India, are the hackeries or kakkris, which are drawn by oxen, and run upon two wheels; the oxen being on particular occasions much ornamented. At Surat the citizens display their taste for magnificence to a great degree in their palanquins, which are a sort of couches upholstered from a bamboo, and borne by four men; one of these carriages, ornamented with silver, covered with rich stuffs, and upholstered upon a handiome bamboo, properly bent, will cost above 200l. sterling.

Surat, and the great distress of which it is the capital, belonged, for a long time, to the Great Mogul, who, to keep his distant province the more effectually in obedience, put it under the government of two nabobs, independent of one another. The one reigned in the city, and was properly the governor of the province; the other had the command of the citadel, and enjoyed the title of admiral, with a small revenue, appropriate to the maintenance of a small fleet, for the defence of the coast against pirates. After Shah Nadir's expedition into Hindoostan, the diffant nabobs of this vast empire aimed all at independence, and left the Mogul nothing but a shadow of authority; asking him only for form's sake to confirm, them in their places. Teg Beg Khan, nabob of Surat, a rich and powerful man, followed this example, and procured his brother to be declared nabob of the citadel. The two brothers then looked upon the whole province as their patrimony, and acquired immense wealth. Teg Beg Khan, dying in 1746, without children, left his fortune to his relations, by which several of them were railed to a condition which enabled them to aspire to the government of the city. His brother died in the following year; and his widow, a woman extremely rich and ambitious,rove to make her son-in-law nabob at once of the town and citadel. The contetl of the different competitors for the supreme authority produced a civil war in the town of Surat. Each of the rivals raised as many troops as he possibly could: with these he cantoned and entrenched himself in his houuse and gardens, and, from time to time, endeavoured to surprize or drive away his opponents. During these houfe operations, which were not attended with great slaughter, the inhabitants were content with fluctuating the gates nearest to the scene of action, and continued to go about their ordinary affairs without fear of being pillaged. Nay, they were sure of receiving compensation whenever any casual injury was done to any person, through means of the disturbances. Hence trade suffered no interruption. Some of the rival candidates impenetrably called in the Mahrrattas; and they, without doing anything for any party, made the victors pay for their alliance, although they had, apparently, favoured the vanquished. Since that time, the Mahrrattas have enjoyed a third part of the revenue amount of the customs of Surat; and one of the officers constantly attends to receive this tribute. The English and Dutch had always kept their factories in a state of defence, and on the occasion of the disturbances, they increased their military preparations. The nabobs of the country then had recourse to those powerful states. Each of the two European nations took part with one of the competitors, furnished him with ammunition, entrenched themselves in their factories, and fought against each other, although not openly at war. The nabob, protected by the English, was at last expelled from the city. But, in 1748, he returned, and his mother-in-law, the rich widow above-mentioned, made so good an ufe of her treasures, that the nabob, for whom he had been expelled, was obliged to ride to him the government of the city. When the English saw the city in the hands of their creature, they began to think seriously of gaining possession of the citadel. The court of Bombay, in 1759, sent Mr. Spencer, one of their members, a man of ability, and beloved by the Indians, to Surat, with a considerable force. The nabob opened the gates of the city to the English, and allowed them to lay siege to the citadel undisturbed. It was taken in a few days. To avoid giving offence to the Indians, the English declared, that they made the conquest in the name of the Great Mogul, and waved his flag from the walls of the citadel. This expedition thus accomplished, Mr. Spencer sent a long representation to the court of Delhi, in which he stated the reasons which had induced the merchants of Surat to put themselves under the protection of the English, and to expel the usurping nabob from the citadel. He added, that those petty tyrants had suffered the fleet necessary for the protection of trade to fall into a state of decay, so that none but the English could restore it. He offered, at the same time, that if the Mogul would grant to the Company the post of admiral, with the revenues annexed to it, they would maintain a fleet which should give full security to trade. These facts were attended, and the proposal seconded by the principal inhabitants of Surat, who signed the memorial. The Great Mogul, who in his state of weakness durst not send a governor to the province, but considered it as lost, readily granted the Company's request: and a member of the council of Bombay now discharged the office of nabob and admiral at Surat. Upon this title, the Company enjoy a third of the revenue from the customs of this city, with other funds of income still more considerable, which enables them to keep on foot a body of troops, with some ships of war. The English are the actual possessors of Surat. They keep the nabob of the city in a state of absolute dependence, allowing him only an income on which he may live suitable to his dignity. The Indians are in pet content with their new masters. The merchants are no longer in danger of the avaricious extortions of the nabobs, and they complain of the selfish spirit of their masters. The Indians dare not fail without a passport from the admiral. The great trade carried on at Surat renders this city the flor of the most productive of Hindoostan. Hither is brought from the interior parts of the empire an immense quantity of goods, which the merchants carry in their ships to the Arabia gulf, the Persian gulf, the coast of Malabar, the coast of Coromandel, and even to China. The provinces near this city are full of manufactures of all sorts. Ship-building is a branch of the business carried on here, for which
which they are furnished, at a low price, with the excellent timber called "teak." Of foreign nations, the Dutch have next after the English the most considerable establishment at Surat: they have here a director, several merchants, a number of writers and servants, and a few soldiers: their trade has, however, declined, till it has become trifling. The affairs of the French are in worse state. This nation is here in no estimation, but what is paid to their capuchin friars, who are generally beloved and respected at Surat. These good regular clergy have done essential service to the public, by keeping a register of all events that have happened in Hindostan, from 1676 to the present time. Such, nearly, is also the condition of the Portuguese in India. Although they were the first Europeans who established themselves here, they are, at present, the least in power and respect. In all appearance, the English must shortly engross the whole trade of this city. Being at once sovereigns and rich merchants, they have every means in their power, by which foreign nations can be excluded, or the Indians restrained from this source of opulence.

Surat, with respect to the English, is subordinate to the presidency of Bombay, which sends one of its members either, under the denomination of chief, who has a council, by which all matters occurring at his factory are settled, subjeet, however, to the approbation of the governor and council of Bombay; 112 miles S. of Amedabat. N. lat. 21° 10' 50" E. long. 73° 50'.

Surat Pengee, a narrow channel of the East Indian sea, between the north point of Sumatra, and a small island called Stony island. N. lat. 5° 32'.

Suraz, a town of Ruffia, in the government of Polotik; 80 miles E. of Polotik. N. lat. 55° 18'. E. long. 25° 34'.

Surazsk, a town of Ruffia, in the government of Novgorod Sieverkoi; 72 miles N.W. of Novgorod Sieverkoi. N. lat. 54°. E. long. 42° 22'.

Surb Grigor, a town of Turkmeh Armenia; 5 miles N.E. of Erzerum.

Surbach, a river of France, which runs into the Rhine, 5 miles below Fort Vauban.

Surbating, in Heaven, is a term used to signify when the soul is worn out, bruised, or spoiled by any accident, as by bad shoeing, especially when the shoes lie flat on the feet; or when the horse goes too long barefoot; as also by travelling on hard roads, or among dry, hot sand, in hot weather, which dries the hoof, whereby the sole becoming hard, presses upon the soft parts beneath it. If a horse be furiously or bad shoeing, the part that is affected may be known by the swells of the sole, where it presses most; and therefore it ought to be pared deeply in that part, before another is put on; but if the foot is not the fault, it may be known that he is furiously or by his continual hitching and moving; but by feeling his hoofs, you may observe them both very hot and dry. According to some the cure is very easy, before it becomes attended with other accidents, and may be performed only by Roping up the feet with cow's-dung and vinegar. Some use only hog's grease hot, thickened with bran; and others make use of vinegar and foot balm, together; but nothing will be more efficacious, in case it be troublesome, than first soothing the sole with the application of soothing things, and after that, pouring a mixture of warm pitch and tar upon the sole of the foot.

Surbilsah, in Geography, a town of Hindooftan, in the circar of Bilbah; 15 miles S.E. of Bilbah.

Surcharge, in the Forest, is when a commoner puts more beaks in the forest than he has a right to. See Forest.
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numbers, or in fractions, any exact root of such number proposed.

And as whenever this happens, it is usual, in mathematics, to mark the required root of such number or quantity, by prefixing before it the proper mark of radicality, which is \( \sqrt{} \), and placing above the radical sign the number that denominates what kind of root is required. Thus \( \sqrt{2} \) signifies the square root of 2, and \( \sqrt{16} \) signifies the cubic root of 16: which roots, because they are impossible to be expressed in numbers exactly (for no effable number, either integer or fraction, multiplied into itself, can ever produce 2; or, being multiplied cubically, can ever produce 16), are properly called surd roots.

There is also another way of notation, now much in use, by which roots are expressed without the radical signs, by their indices: thus, \( n, \sqrt{n}, \sqrt[n]{n} \), &c. signify the square, cube, and fifth power of \( x \); \( \sqrt{5}, x^\frac{1}{5}, x^\frac{1}{5} \), signify the square root, cube root, &c. of \( n \).

The reason of which is plain enough; for since \( \sqrt{x} \) is a geometrical mean proportional between 1 and \( n \), \( \sqrt[3]{n} \) is an arithmetical mean proportional between 0 and 1; and therefore \( \sqrt[5]{x} \) is the index of the square of \( \sqrt[5]{n} \), which is the proper index of its square root, &c.

Observe also, that, for convenience, or brevity's sake, quantities or numbers, which are not surds, are often expressed in the form of surd roots. Thus, \( \sqrt[4]{2}, \sqrt[4]{4}, \sqrt[4]{7} \), &c. signify \( 2, 4, 7 \), &c. But though these surd roots (when truly such) are inexpressible in numbers, they are yet capable of arithmetical operations (such as addition, subtraction, multiplication, division, &c.); how readily to perform which the algebraist ought not to be ignorant.

For the method of performing these operations, see the sequel of this article.

Surdts are either simple or compound.

Surdts, Simple, are those which are expressed by one single term, as \( \sqrt{c} \).

The surds \( \sqrt{2}, \sqrt{3}, \sqrt{5} \), &c. though they are themselves incommensurable with unit, according to the definition, are commensurable in power with it, because their powers are integers, i.e. multiples of unit. They may be also sometimes commensurable with one another; as the \( \sqrt{8} \) and the \( \sqrt{2} \), because they are to one another as 2 to 1. These incommensurables are called by some communicable: and when they have a common measure, as \( \sqrt{3} \) is the common measure of both, then their ratio is reduced to an expression in the least terms, by dividing them by their greatest common measure. This common measure is found as in commensurable quantities, only the root of the common measure is to be made their common divisor.

Thus, \( \sqrt[3]{8} = \sqrt[3]{2} = 2 \), and \( \sqrt[3]{18} \) = \( \sqrt[3]{2} \).

Surdts, Compound, are those formed by the addition or subtraction of simple surdts: as \( \sqrt{5} + \sqrt{2}, \sqrt{5} - \sqrt{2} \), or \( \sqrt{7} + \sqrt{2} \); which last is called an unscorable root, and signifies the cubic root of that number, which is the result of adding \( 7 \) to the square root of \( 2 \).

1. To reduce rational Quantities to the Form of any surd Roots assigned.—Involve the rational quantity according to the index of the power of the surd, and then prefix before it the radical sign of the surd proposed. Thus, \( a = \sqrt[n]{a^n} \).

\[ \sqrt{a^2} = \sqrt{a^2} = \sqrt{a}; \quad \text{and} \quad 4 = \sqrt{16} = \sqrt{64} = \sqrt{256} = \sqrt{4}. \]

And by this way may a simple furd fraction, whose radical sign refers only to one of its terms, be changed into another, which shall respect both numerator and denominator. Thus, \( \frac{\sqrt{a}}{5} \) is reduced to \( \frac{\sqrt{a}}{5} \), and \( \frac{\sqrt{a}}{25} \) to \( \frac{\sqrt{a}}{25} \):

\[ \frac{\sqrt{2}}{4} \]

also \( a \) reduced to the form of \( a^n \) is \( a^n \).

And roots with rational co-efficients may thus be reduced so as to be wholly affected by the radical sign. Thus, \( a \times \sqrt[3]{a} = a \sqrt[3]{a^2} \).

2. To reduce simple Surdts, having different rational Sps (which are called heterogeneous Surdts), to others that may have one common radical Sign, or which are homogeneous: or to reduce Roots of different Names into those of the fame Name.—Inolve the powers reciprocally according to each other’s indices, for new powers; and let the product of the indices be the common index. Otherwise, as surdts may be considered as powers with fractional exponents, reduce these fractional exponents to fractions having the same value, and a common denominator. Thus, by either rule, \( \sqrt[n]{a} \) or \( a^n \), and \( \sqrt[n]{n} \) or \( n^n \), will be \( \sqrt[n]{n} \) or \( n^n \), and \( \sqrt[n]{n} \) or \( n^n \), and \( \sqrt[n]{n} \) or \( n^n \).

Also \( \sqrt[3]{3} \) and \( \sqrt[2]{2} \) are reduced to other equal surds \( \sqrt[27]{27} \) and \( \sqrt[4]{4} \) having a common radical sign.

3. To reduce Surdts to their most simple Expressions, or to its lowest Terms possible.—Divide the furd by the greatest power denoted by the index, which you can discover, and multiply it, and will make it without any remainder; and then prefix the root of that power before the quotient or furd is divided; this will produce a new surd of the fame value with the former, but in more simple terms. Thus, \( \sqrt[16]{4} \) by dividing by 16 \( 4 \), and prefixing the root \( 4 \), will be reduced to this, \( 4 \sqrt[4]{4} \), and \( \sqrt[12]{4} \) will be deprefred to \( \sqrt[2]{3} \).

Also \( \sqrt[3]{b} \) will be brought down to \( b \sqrt[3]{c} \).

To reduce \( a^n \) to its lowest term: suppose \( n \) the greatest power, that will divide \( a \) without a remainder; and let \( y = \frac{a}{n} \) then will \( a \) \[ a = n \times y \]; for \( a = x \).

therefore \( a = \left( n \times y \right) = n \times y \), \[ a \times y \]

Also \( \sqrt[75]{75} \) or \( \sqrt[75]{5} \) = \( 5 \times 3 \), or \( 5 \times 3 \) and \( \sqrt[81]{81} \) = \( 27 \times 3 \), or \( 27 \times 3 \) = \( 3 \times 3 \).

This reduction is of great use, whenever it can be performed; but if no such square, cube, biquadrate, &c. can be found for a divisor, find out all the divisors of the power of the furd proposed; and then see whether any of them is a square, cube, &c. or such a power as the radical sign denotes; and if any furd can be found, let that be used in the fame manner as above, to free the furd quantity in part from the radical sign. Thus if \( \sqrt{288} \) be propred, among its divisors will be found the squares, 4, 9, 16, 36, and 144: by which, if 288 be divided, there will result the quotients 72, 32, 16, 9, and 2; wherefore, instead of \( \sqrt[288]{288} \).
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\[ \sqrt[n]{288} \text{ you may put } 2 \sqrt[3]{72}, \text{ or } 3 \sqrt[3]{32}, \text{ or } 4 \sqrt[6]{18} \text{ or } 6 \sqrt[6]{8}, \text{ or, lastly, } 12 \sqrt[3]{2}; \text{ and the same may be done in species.} \]

By the two last problems we may determine, whether any two roots are commensurable one to another; and also find their ratio. For after reduction into the lowest terms, and the same name, if the powers are equal, the roots are commensurable, and their ratio is equal to that of the rational co-efficients. Thus, \( \sqrt[3]{75} \) and \( \sqrt[3]{27} \) reduced, will be \( 5 \sqrt[3]{3}, \) and \( 3 \sqrt[3]{3}, \) which are commensurable; and \( 5 \sqrt[3]{3} : 3 \sqrt[3]{3} :: 5 : 3. \)

4. To add and subtract Surds. — When they are reduced to their lowest terms, if they have the same irrational part, add or subtract their rational co-efficients, and prefix the sum or difference to the common irrational part. Thus,

\[ \sqrt[3]{75} + \sqrt[3]{48} = 5 \sqrt[3]{3} + 4 \sqrt[3]{3} = 9 \sqrt[3]{3}; \] \[ \sqrt[3]{a^2} + \sqrt[3]{b^2} = a + b \text{ and } \sqrt[3]{a^2} - b = a \sqrt[3]{a} - b \sqrt[3]{a}. \]

And \( \sqrt{150} - \sqrt{34} = 5 \sqrt{6} - 3 \sqrt{6} = 2 \sqrt{6}. \) If they have not the same irrational part, they can only be connected by the sign + or −.

Hence it appears, that the sum or difference of any two square roots is equal to the square root of the sum or difference of the sum of the powers, and twice the product of their roots.

E.g., \( \sqrt[3]{75} + \sqrt[3]{48} = \sqrt[3]{75 + 48} + \sqrt[3]{2 \times 5 \times 3} = \sqrt[3]{123} = 9 \sqrt[3]{3}. \)

For if \( \sqrt[3]{a^2} \) and \( \sqrt[3]{e^2} \) be any given quantities, it is plain that \( a \sqrt[3]{a} \pm e \sqrt[3]{e} = a \pm e = \sqrt[3]{a^2} + 2 ae + 2 \sqrt[3]{a}. \)

5. To multiply and divide Surds. — If they have the same rational quantity, they are multiplied by adding their indices, and divided by subtracting them. Thus, \( \sqrt[3]{a} \times \sqrt[3]{a} = a^{\frac{3}{6}} = a^{\frac{1}{2}} = \sqrt[3]{a}. \) and

\[ \sqrt[3]{2} \times \sqrt[3]{2} = \sqrt[3]{2^2} = \sqrt[3]{3}. \] \[ \text{Also, } \frac{\sqrt[3]{a}}{\sqrt[3]{a}} = a^{\frac{3}{6}} = a^{\frac{1}{2}} = \sqrt[3]{a}. \]

If they have different rational quantities, and the same sign, multiply these rational quantities into one another, or divide them by one another, and let the common radical sign over their product: thus, \( \sqrt[3]{a^2} \times \sqrt[3]{b^3} = \sqrt[3]{a^2 b^3} \) and \( \sqrt[3]{a^2} \div \sqrt[3]{b^3} = a^{\frac{1}{2}} \div b^{\frac{1}{3}} \) and \( \sqrt[3]{a^2} \div \sqrt[3]{b^3} = \sqrt[3]{a^{\frac{1}{2}} b^{\frac{1}{3}}}. \) \[ \text{and } \sqrt[3]{5} \div \sqrt[3]{3} = \sqrt[3]{5 \div 3} \] \[ = \frac{\sqrt[3]{5}}{\sqrt[3]{3}}. \]

If the Surds have not the same radical sign, reduce them (by prob. 2.) to such as shall have the same radical sign, and proceed as before. Thus, \( \sqrt[3]{a} \times \sqrt[3]{b} = \sqrt[3]{a b}; \) and \( \sqrt[3]{2} \times \sqrt[3]{4} = 2 \sqrt[3]{2} \times 4 = 2 \sqrt[3]{2^3}. \) \[ 4 \div 2 = \sqrt[3]{2^2} \div \sqrt[3]{2} = \sqrt[3]{2}. \] \[ 4 \div 2 = \sqrt[3]{2}. \] \[ \text{If the Surds have any rational co-efficients, their product or quotient must be prefixed.} \]

Thus, \( 2 \sqrt[3]{3} \times 5 \sqrt[3]{6} = 10 \sqrt[3]{18} \) and \( \frac{8 \sqrt[3]{5}}{2 \sqrt[3]{6}} = \) \[ \frac{\sqrt[3]{5}}{3}. \]

6. Evolution and Evolution of Surds.—The powers of Surds are found by multiplying their indices by the index of the power required. Thus, the square of \( \sqrt[3]{2} \) is \( \sqrt[3]{2^2} = 2 \sqrt[3]{2} \) and \( \sqrt[3]{2} \) of \( \sqrt[3]{3} \) is \( \sqrt[3]{3^2} = 3 \sqrt[3]{3}. \) \[ \text{And } \sqrt[3]{3} \div \sqrt[3]{3} = \sqrt[3]{3 \div 3} = \sqrt[3]{1} = 1. \]

Evolution is performed by dividing the fraction which is the index of the Surd, by the name of the root required. Thus, the square root of \( \sqrt[3]{a^2} \) is \( \sqrt[3]{a^2} \) or \( \sqrt[3]{a^3}. \)

Simple Surds are commensurable in power, and by being multiplied into themselves, give, at length, rational quantities. But compound Surds, multiplied into themselves, commonly give irrational products. Yet, in this case, when any compound Surd is proposed, there is another compound Surd, which, multiplied into it, gives a rational product. Thus, \( \sqrt[3]{a^2 + \sqrt[3]{a^3}} \) or \( \sqrt[3]{a^2 + \sqrt[3]{b^3}} \) or \( \sqrt[3]{a^2} \) of \( \sqrt[3]{b^3} \), the product will be \( a - b. \)

The investigation of that Surd, which multiplied into the proposed Surd, gives a rational product, is made easy by three theorems, delivered by Mr. Maclaurin, in his Algebra, p. 109, eq. to which we refer the curious. This operation is of use in reducing Surd expressions to more simple forms. Thus: suppose a binomial Surd divided by another, as \( a \sqrt[3]{20} \div a \sqrt[3]{12} \) by \( b \sqrt[3]{5} \div b \sqrt[3]{3} \) the quotient might be expressed by \( \frac{2 \sqrt[3]{20} + 2 \sqrt[3]{12}}{2 \sqrt[3]{5} - 2 \sqrt[3]{3}} \). But this might be expressed in a more simple form, by multiplying both numerator and denominator by that Surd, which multiplied into the denominator, gives a rational product: thus, \( \sqrt[3]{20} + \sqrt[3]{12} \div \sqrt[3]{5} = \sqrt[3]{20} + \sqrt[3]{12} \div \sqrt[3]{5} = \sqrt[3]{20} + \sqrt[3]{12} \div \sqrt[3]{5} = \sqrt[3]{20} \div \sqrt[3]{5} + \sqrt[3]{12} \div \sqrt[3]{5} = \sqrt[3]{100} + \sqrt[3]{60} + \sqrt[3]{60} = 8 + 2 \sqrt[3]{15}. \)

To do this generally, see Maclaurin, lib. cit. p. 115.

When the square root of a Surd is required, it may be found,
found, nearly, by extracting the root of a rational quantity that approximates to its value. Thus, to find the square root of $3 + 2\sqrt{2}$, first calculate $\sqrt{2} = 1.41421$. Hence, $3 + 2\sqrt{2} = 5.82842$, the root of which is found to be nearly $2.41421$.

In like manner we may proceed with any other proposed root. And if the index of the root, proposed to be extracted, be great, a table of logarithms may be used.

Thus, $\sqrt[5]{5 + \sqrt{17}}$ may be most conveniently found by logarithms.

Take the logarithm of 17, divide it by 13; find the number corresponding to the quotient; add this number to 5; find the logarithm of the sum, and divide it by 7, and the number corresponding to this quotient will be nearly equal to $\sqrt[5]{5 + \sqrt{17}}$.

But it is sometimes requisite to express the roots of surds exactly by other surds. Thus, in the first example, the square root of $3 + 2\sqrt{2}$ is $1 + \sqrt{2}$.

For the method of performing this, the curious may consult Mr. Maclaurin's Algebra, p. 115, seq. where also rules for trinomials, &c. may be found.

For extracting the higher roots of a binomial, whose two members are squares or commensurable numbers, we have a rule in Sir Isaac Newton's Arithmetica Universalis, p. 59, but without demonstration. This is supplied by Mr. Maclaurin, in his Algebra, p. 120, seq. as also by S. Graveland, in his Matheseos Universalis Element. p. 211, seq.

It sometimes happens, in the resolution of cubic equations, that binomials of this form $a + b\sqrt{-9}$ occur, the cube roots of which must be found. To these Sir Isaac's rule cannot always be applied, because of the imaginary, or impossible factor $\sqrt{-9}$; yet if the root be expressible in rational numbers, the rule will often lead to it in a short way, not merely tentative, the trials being confined to known limits. See Maclaur. loc. cit. p. 127, seq.

It may be further observed, that such roots, whether expressible in rational numbers, or not, may be found by evolving the binomial $a + b\sqrt{-9}$, by the Newtonian theorem, and summing up the alternate terms. Maclaur. loc. cit. p. 150.

Those who are desirous of a general and elegant solution of the problem, to extract any root of an impossible binomial $a + \sqrt{-b}$, or of a possible binomial $a + \sqrt{b}$, may have recourse to M. de Moivre's Letter to Dr. Saunderson, inferred by way of Appendix to his Algebra, and to the Philosophical Transactions, No. 455; or to Dr. Marty's Abridgment, vol. viii. p. 1, seq. See also on the management of surds, Kerley's Algebra. Ward's Mathem. part ii. cap. 4. Jones's Synopsis. Palm. Math. part i. &c. 3. cap. 6. Saunderson's Algebra, vol. ii. Bonnycastle's Algebra, &c. &c.

SURDS, Commensurable. See Commensurable.

SURDS, Heterogeneous. See Heterogeneous.

SURDS, Homogeneous. See Homogeneous.

SURDAH, in Geography, a town of Hindoostan, in Bengal; 15 miles S.W. of Natore.—Allo, a town of Hindoostan, in the cirec of Ruttunpour; 18 miles N.E. of Dundah.—Allo, a town of Bengal; 10 miles S.E. of Baulacah.

SURDE, or SURDY (Sourê). See Schech Souré.

This island, situated in the Red sea, nearly east of Nobhure (Faloor), appears at first sight like a two-masted vessel. It is not far from Sheikh Shaib, called by d'Anville Bafheeb, which is one of the largest islands in the gulf, and inhabited.

SURDESOLID. See Surdesolid.

SUREAU, in Geography, a river of Louisiana, which runs into the Missour, N. lat. 38° 54', W. long. 92° 47'.

SUREN, a river of Switzerland, which runs from the lake of Sempach into the Aar, 2 miles N.E. of Arau.

SURENHSUS, WILLIAM, in Biography, a celebrated Hebrew scholar in the university of Amsterdam, well known for his edition of the Mishcach, with notes and a Latin version, which he began to publish in 1698, and completed in 1703, in 3 vols. fol. It contains also the commentaries of the rabbins, Maimonides and Barthenofa.

SURETY, in Law, a bail that undertakes for another man in a criminal case, or action of trespass, &c. See Fire-Juffer.

SURETY of the Peace, an act by which a person in danger of hurt from another, is forsworn by a bond, or recognizance acknowledged by the other to the king, and bound with him, for keeping the peace. See Securitas Pactic.

This security a justice of the peace may command, either as a minister, when commanded thereto by higher authority; or, as a judge, when he doth it of his own power, derived from his commission.

It differs from jury of good abearing, in that whereas the peace is not broken without an affray, or such like: the jury de bono gesta may be broken by the number of 10 men, or by his or their weapon, or harm.

See Peace, and Good Abearing.

SURF, in Agriculture, a term sometimes, in draining, applied to a fough, which is the conduit or bottom part of a drain, when formed with brick or stones. See Drainage.

SURF of the Sea, the swell of the sea, which breaks upon the shore, or any rock lying near the surface of the sea; and which renders such places dangerous.

The surf forms sometimes but a single range along the shore; at other times there is a succession of two, three, four, or more, behind each other, extending perhaps half a mile out to sea; the number of ranges being generally a proportion to the height and violence of the surf. The force of the surf is very great. In some places the surfs are usually greater at high, and in others at low water; but they are said to be uniformly more violent during the spring-tides. Mr. Mardin, in his History of Sumatra, has made some ingenious observations on the cause of surf in general, and particularly on the phenomena of the same which occur on the coast of that island.

When a wave is at its height, it defends the force of gravity, and the momentum acquired in defeding impels the neighbouring particles, which, in their turn, rise and impel others, and thus form a furzification of wave. This is the case in the open sea; but when the swell approaches the shore, and the depth of water is not in proportion to the size of the swell, the furzification waves, instead of preying on a body of water, which might rise in equal quantity, preys on the ground, whose reaction causes it to rush on in the manner which we call a surf. Some have stated, that in forming a surf, the body of water has no actual progressive motion.
Mr. Marsten denies this fact, and says, that the only real progression of the water is occasioned by the perpendicular fall, after the breaking of the surf: when, from its weight, it flows on to a greater or less distance, in proportion to the height from which it fell, and the slope of the shore. That the surfs are not, like common waves, the immediate effect of the wind, is evident from this circumstance, that the highest and moft violent often happen when there is the least wind, and vice versa; and sometimes the surfs will continue with an equal degree of violence during a variety of weather. On the west coast of Sumatra, the highest surfs are experienced during the south-east monfoon, which is never attended with such gales of wind as the north-west. The motion of the surf is not observed to follow the course of the wind, but often the contrary; and when it blows hard from the land, the spray of the sea may be seen to fly in a direction opposite to the body of it, though the wind has been for many hours in the same point. The surfs do general in the tropical latitudes are, as our author apprehends, the consequence of the trade or perpetual winds which prevail, at a distance from shore, between the parallels of 30° N. and S., whose influence on the ocean causes a long and constant swell, which exists even in the calmest weather, about the line, towards which its direction tends from either side. This swell, when a squall happens, or the wind freshens up, will, for the time, have other subsidiary waves on the extent of its surface, breaking often in a direction contrary to it, and which will again subside as a calm returns, without having produced on it any perceptible effect. For further observations on this subject, we refer to Mr. Marsten's Hist. of Sumatra, p. 52, &c.

**SURFACE.** In Geometry, see SUPERFICE.

**Surface,** in Ornamental Gardening, that part of natural, easy, agreeable, and tasteful connection of the different parts of the surface of ornamented grounds, which constitutes and affords beauty, variety, and ornamental effect in them. It has been observed by Mr. Loudon, in his work on forming, improving, and managing country residences, that connection is essentially requisite to the formation of character in such situations; and that nothing in ground is so disagreeable as its interruption, and the want of suitable, neat, natural connection in its several superficial parts. It is well and truly said, that the most beautiful mound formally placed upon a level, or the most elegant sweep, amid abruptness and irregularities, will ever be discordant and disfiguring. That in undulating and simple surfaces, the parts ought to co-operate with each other in producing every variation and agreeable diversity of form; and in picturesque surfaces, the union of abruptness and broken ground should neither be forced, regular, tame, nor unmeaning. That a level surface, broken into holes, or covered with heaps, is totally different from a picturesque surface; and that even an irregular surface, uniformly abrupt or broken, is but another variation of the same deformity and defect. That in picturesque ground, the surface should either be rising, falling, or irregular; in the rising surface, the breaks and abrupt ascents should succeed each other, or be interpolated so as, standing below and looking upwards upon them, they may seem to favour the general tendency to rise; and standing above, and looking down over them, they may appear in union with the nature of the declivity. That a hollow without an outlet, or a circular mound without a uniform and continuous continuation of swell, are alike unnatural and disagreeable.

It is suggested, that wood may render undulating surfaces more characteristic, by being planted on the eminences; that it may give expression and effect to tame formal hills, by judicious disposition upon their sides, so as to vary both their surface and sky outline, and that it may even render an uninteresting common intricate and varied. That a few trees falling down a declivity or precipice, increase the appearance of steepness; and a wood covering the bafe, and creeping up to various heights on the side of a hill, adds greatly to its apparent height and grandeur. That a surface full of deformities, either hollows, pits, or unconnected excrescences, may, by a judicious distribution of wood, be rendered highly picturesque. That solitary hills, formally placed upon a level surface, the heights of small scale sufficing by adding earth to the angle formed by the junction of their base with the general surface, may, it is thought, by placing wood in the junction, be completely united with everything around. Accident has sometimes produced this effect, as where there is a conical hill which rises abruptly from the surface of a level or gently varied country; in which case the greater part of the base of the hill, and the lower parts of its sides, may often be also planted for the same purpose. But the effect of wood in changing the appearance of ground, though most striking upon a large scale, and in the hands of those skilful in handling for effect, it is thought, that even a few narrow-loads of earth on a knoll, or a continuation of swell on each side of a walk or fore-ground, will make some difference, even though clothed only with pasture: but if planted with trees, they produce shade and character immediately; and that they may conceal deformities in the distance, serve as a frame or fore-ground to distant beauties which might pass unperceived, or they may give importance to the scene itself from other points of view, or places from which they may be seen.

It is evident, therefore, that for connection of surface in ground where ornament, variety, and beauty, are to be produced, it is a matter of very great utility and importance in many different ways and intentions, and to which no inconsiderable attention is necessary in laying out all sorts of pleasure-grounds, but especially those of the more extensive kind.

**Surface, Planning and Modelling of,** that sort of planning and modelling which exhibits or displays the different kinds of improvements which are capable of being introduced in forming, improving, and beautifying all sorts and descriptions of country residences, and which includes or is connected with other objects and ornaments connected with them.

The models, in wood, of five different kinds of improvements in hot-houses, which form and constitute the principal ones, which Mr. Loudon, an ingenious improver of rural scenery, has introduced into such houses, are to be purchased and had in London as well as Edinburgh. These are said to have been found of great service to gentlemen, by enabling their workmen to construct such useful improvements with ease and certainty. Without some such assistance, it is well known this sort of business is often not only badly managed, but very tedious and troublesome.

It has been asserted by the writer of a late work on forming and improving country residences, that, before any thing is fixed upon relative either to the formation or improvement of a rural residence, or any of its parts, whether principal or complex, a plan or ideal scheme of the whole should be previously formed in the mind of the artist or improver, and embodied on paper, for the inspection or mature consideration of the proprietor and his friends. For this purpose, the situation should, it is said, be fully examined with respect to soil, visible beauty, and prospects, and also the relative advantages and disadvantages of climate and other matters. The best method of acquiring such knowledge is, it is thought, to visit the place at different seasons, before comple
SURFACE.

pleting the design. In this manner, observation may embrace, and reflection digest, the emotions excited in the mind of the artist or improver, by its diverse qualities, or in other ways.

It is suggested that the iconography, and bird's-eye views, of the present state of the whole should first of all be delineated, and geometrical sections made, where water or similar works may be hinted to be had. Upon these, especially the ground-plan, the designer may lightly sketch with red, or any striking colour, the proposed improvements, in some proper manner. After which he should make out a plan, bird's-eye views, sections, elevations, and other suitable designs, showing what may be the effect of the proposed improvements at a certain future period, suppose three or seven years, after they have been executed. This should be accompanied by perspective views of the most interesting parts or passages of the scenery, or of the buildings in their present state; and by other sketches, shewing the effect of improving them. The whole of which, except the larger ground-planes (which may generally be fixed on canvas and rollers), should be incorporated with a manuscript volume, giving some account of the present state of the place (which will always be interesting after the alterations are made), and mentioning the leading reasons for proposing the improvements, and the general directions for executing them. Either here, or more properly in a detached appendix, should, it is said, be given an estimate of the expense of the whole. In connection with these plans and other things, it has been found, it is said, of great advantage, in many irregular situations, to construct models both of the present state and proposed improvements; and not only of the buildings, but also of the ground-surface, the water, gardens, hot-houses, and villages, both in their present and improved state.

The fame writer has lately, it is said, invented a very ingenious method of modelling estates, which will be of very considerable advantage to landed proprietors, particularly those intending to improve, to decorate, or build upon their farms or grounds. In this kind of modelling, the variation of the surface is shown exactly as it is in reality; and all the trees, hedges, roads, rivers, buildings, and other matters, are accurately raised on the models, agreeable to a certain scale; and, afterwards, the whole is coloured from nature. There is annexed a manuscript volume of references, containing the names of the different farms and fields, the contents of each, and the nature of its soil and other matters, with every other requisite information. The inventor has also contrived such a model, which may not be used without previous preparation, and by which any gentleman may try, upon the model, the effect of any proposed alteration or improvement: and also a small wire net, each mesh of which is equal to an acre, by which the contents of any part may be instantly known by applying it, and numbering the meshes which cover the field or space to be measured. From the nature of the model, any changes which may afterwards be made in the ground can be inferred without injuring the piece; and hence no estate will ever, it is said, require to be remodeled. The remarkable objects upon an estate, such as the mansion house, &c., can also, to give a clearer view of them, be modeled separately, upon a larger scale than the general plan.

The unwieldiness and bulk of such a model would at the first sight appear to be an inconvenience; but by dividing it into separate parts, which parts are kept in a small chest or box, and may be taken out and fitted together in a few seconds, it occupies little more room than a plan of the ordinary kind,

The advantages which the inventor thinks will attend this mode of imitating estates are these: first, that a proprietor will see a correct imitation or miniature of his estate, in the clearest manner, and without the risk of being misled or deceived by a plan: secondly, that every proposed alteration or improvement, of whatever kind, will be clearly understood, and may be foisted out to workmen; so that they may, it is thought, execute it with superior ease and certainty. In planning and forming country seats, this will be of immense advantage; and, as a further assistance to it, the discoverer has also invented a kind of working-plan, which will enable workmen to execute exactly the arrangement of trees, shrubs, and flowers, about any place, in a manner agreeable to the principles which have been laid down and explained in the inventor's work on country residences. Those who understand the mode of arrangement there exhibited and explained, and can compare it with the common mode of mixing all sorts of trees indiscriminately, will, it is thought, be convinced that this improvement is of great utility; thirdly, that the effect of every alteration proposed may be clearly seen before it is executed; whether it be the effect that changing the lines of fences, roads, &c. will have, in altering the contents of the adjoining enclosures (and this can be infinitely found by using the wire-netting); or the effect of the addition of wood or buildings, whether useful or ornamental. It is almost needless to add, that the scheme of improvement can be altered and varied upon the model, until the best effect shall be produced, which effect may afterwards be exactly imitated upon the grounds. The making trials, on the model, of the effect of alterations, will, it is said, form a very instructive and rational amusement for proprietors at certain leisure times.

Two models of this kind, one shewing the present appearance and contents of an estate in general, and the other the effect of an intended new place of residence for the proprietor, have, it is said, been already formed; to the latter of which has been added an elegant manuscript volume, illustrated by drawings and sketches containing the inventor's ideas of the situation; his reasons for proposing the improvements, and practical directions for executing them; accompanied with working-plans, a large vertical profile, shewing the effect of the whole, and a general estimate of the expense of the execution, &c.

Several improvements in the method of constructing and forming such models have since the above, it is said, been made; so that ten thousand acres of surface may now be modeled on a sufficiently large scale, and the weight of the model of the ground, without any danger of being broken or tarnished: and, what certainly deserves the consideration of the landed interest, a plan of the whole may, it is said, be modeled in this way for little more than the expense of a common survey.

It is remarked, that the neglect of improvers, in not preconceiving a plan of the whole before proceeding to operate upon the parts, has often occasioned them much useless expense and trouble, of which they are commonly not aware until it be too late. So many instances of this occur in every part of the country, it is said, that it is allowing them they should not be more cautious in embarking in such extensive undertakings without a much greater certainty of success. Even some who have formed and arranged a plan in their minds previously to proceeding, have misconceived effects from deficiency in practical knowledge; and have often gone farther wrong than the others, from a false estimate of their own powers. The neglect of having a plan from an artist or proper improver, which will, it is said, at least always furnish some hints, is thought generally advices to the real interest of a proprietor; as confiding such matters or improvers may often save no little expense.
SURFACE.

Surface, Covering of, in Hot-beds, the means of covering over superficially the foil or mould of such beds. This has, for the most part, principally been confined to some sort of thin earthy material; but lately other sorts of substances have been had recourse to for the purpose, which are of a more dry and forcing nature, with great success in particular cafes of these beds, and in pinnaries, and other places.

A writer in the first volume of the "Memoirs of the Caledonian Horticultural Society," directed in this intention, the laying on the surface of such beds, fine drifted river or peat-sand, to the depth or thickness of three inches. This kind of covering, it is said, possessses many advantages. It will extirpate the flatter, or wood-louche, as the nature of the sand prevents the infect from concealing itself from the rays of the sun. In dung hot-beds, it keeps down the steam; and to fruit, it affords a bed as warm and as dry as tiles or flates. This covering also retains the moisture in the earth longer than any other, and is itself sooner dry. Besides, it gives the house a clean nest appearance; and though it cannot be expected to remove the infection where already introduced, it will be found a powerful preventive of that great evil, mildew.

Surface, Perforation of, the practice of boring into it, for the purpose of discharging any injurious water that it may contain within its internal parts, by means of the draining auger, and that of examining and searching into it by the borax or other implements, for the purpose of discovering and detecting any kind of substances that may be useful or valuable to the farmer or other person; such, for instance, as marles, chalks, and other earthy matters, coals, minerals, and various other bodies. See Bore, Spring-Draining, and Tapping of Springs.

Surface Land. See the next article.

Surface Soil, a term sometimes applied to the layer of earthy materials in which crops grow, and which is not unfrequently called the plant-feeding bed or stratum, in contradistinction to the layer or body of substances on which it rests.

The depths of the surface layers of cultivated lands have, however, in some measure, their limits, which may probably with propriety be fixed at from three or four to fifteen inches or more, according to circumstances; as though, in many instances, the component parts of these beds are of a pretty uniform state, to a greater depth than the greatest of these, an uniformity of colour and vegetative quality but seldom reaches to that depth. The influence of the surrounding atmosphere, the living and reduced dead fibres of vegetables, the operations and effects of animalculce and larger animals, which inhabit and infest such superficial beds of lands, and above all the powerful action and effects of substances of the manure kinds, tend to furnish the surface mouldy materials with qualities which the substrata have not the means of acquiring.

The medium depth of the cultivated layers of the surface soils of this country, may probably be set down with sufficient accuracy at about nine or ten inches, as though the larger part of them may not attain to that depth, the greater extent of them, it has been thought, might, under proper regulation and management, be brought to such a depth with great utility and advantage. See Soil.

Surface or Running Level, a term used to signify that sort of level which conducts water. It has been remarked, by the writer of a late work on landed property, that though it is a solecism in language, it is useful as a technical phrase. It is made use of in contradistinction to the dead level in the work of draining land, which, though that may be capable of conducting water through a pipe, is quite un

fit for carrying it along a trench. A living stream gives, it is said, a firmness and tightness to the bottom of a cut or channel, in which stagnant or slowly moving waters would sink. The fall of about one per cent. is sufficient, it is thought, in ordinary cafes of drains or runs of water. But where the bottom of the trench or channel is firm, one inch, foot, or yard, in two hundred, will suffice; and may be had recourse to in cases where a greater fall cannot, without disadvantage and inconvenience, be allowed in the run.

Surface-Drain, a name applied to that sort of tool of this kind which is employed for rendering the superficial parts of tillage lands clear of weeds, and in a fine powdery state, proper for the reception of the seed. These kinds of drags are most commonly used for preparing for wheat crops, and the working of small harrows; but they may be had recourse to for many other sorts of crops with equal utility and advantage. There are several different kinds of them sued for working on different sorts of soils or lands. They should always be well suited to the quality of the land on which they are intended to work.

They are sometimes formed with nine sharp spares in a sort of long triangular manner; which sort operates well on poor land in a high dry situation, making little furrows or drills at the distance of about two inches or two inches and a half apart, and two or three inches in depth, for the feed. It, however, requires some considerable strength of team or power in drawing it. At other times they are made in a kind of leaf manner, the parts of which fold together, in which form they are particularly useful on some occasions. See Swing-Drain.

In still other instances they are made large, wide, and heavy, without any divisions in them; a mode of construction liable to objections. These are occasionally too formed in the first manner as to their wood work, but have smaller tines hooked towards the points, and sometimes double rows of tines. In these modes they are more certain and powerful in removing and collecting all sorts of small root-weeds from land.

There is also a sort of very heavy coupled tool of this kind, in which both the wood and iron work are very strong, which has something of the harrow form, and the different parts of which are coupled or united together in somewhat a similar manner to that which is used for that tool in some cafes. These answer extremely well on lands of the more strong thistle kinds, when employed at proper feasons.

Tools of this sort are essentially necessary for, and of great utility to, the arable farmer.

Surface Dragging, a term applied to the practice of working over the surface of land of the arable kind, by means of tools of the drag kind. It is a necessary and very useful operation on most sorts of soils or lands at different times, but especially just before the sowing or putting in the seed, as the surface is thereby well broken down and rendered fine for it, from which a great many advantages are derived to the seed and growth of the crops. See the preceding article.

Surface-Drain, that sort of superficial drain or opening which is calculated to carry off the injurious wetness which remains on or in the superficial parts of lands or soils.

Depth and Width of the Drains.—The writer of the account of Elkington's mode of freeing land from water remarks, that in surface hollow drains, the depth must always vary according to the nature of the soil, the situation of the field, the expense the farmer is willing to incur, and a diversity of other circumstances. Many years ago, it is said, three fort
were the common depth in most foils; but for twenty years past, they have, it is thought, seldom exceeded thirty or thirty-two inches; and the number that are cut to only twenty-four or twenty-six is much more considerable. The main or receiving drains are always, it is noticed, made a little deeper than the others, having more water to convey, and farther to carry it in most instances. Whenever the spade reaches an impervious foil, through which water will not percolate, there is no occasion for making the trench deeper or lower in the foil. One general rule should never be departed from, which is, that the depth must be sufficient to prevent the impotence of the feet of cattle from affecting the position of the materials used in filling them.

It is said, that in forming these forts of drains in all the modern drainages in the eastern counties, the farmers have been very solicitous to cut them as narrow as possible, by which means a great saving is made in the materials used for filling them, such as bulks, poles, sprays, or fraws; but if bricks or stones are used, of course this rule cannot be adhered to. However, there is no occasion, it is thought, for the width being greater than one foot, if the foles are only coupled at bottom, or thrown in promiscuously, or more than fifteen inches, if laid in form of a conduit. Whatever the depth of material be, in making the furrows, the surface should never be less than one foot thick, or rather more, in all tillage fields. In pasturage land, gravel, if it be at hand, especially if the soil be very tenacious, is preferable to the mould thrown out, which may be spread on any adjoining hollow.

The depth and width of about thirteen inches in the former, and in the latter from eighteen to twelve, or more, are the proportions that ought, it is thought, to be adopted on all land that is wet from surface water, or from its stagnation in the rainy season.

Digging and forming the Drains.—The best modes of having these forts of work performed, both in cutting and filling, in order to perfectly secure the success of the drains, are perhaps to employ the labourers by the day, and to engage none but such as are fully acquainted with the business.

In the making of drains of the surface kinds, tools or implements of the simple spade kind were formerly, for the most part, had recourse to in all the eastern parts of the country. Three such spades were formerly used, levelling gradually up, so as to form a regular narrowing to the bottom; but by previous ploughing or making furrows, to all the spades, except the lowest one, have mostly been laid aside in many cases; and even where a greater depth than usual has been necessary, not more than two have commonly been employed. And the spade, which is pushed or drawn along the bottoms of the drains, in order to clear out the loose crumby or mouldy parts, and render them fit for receiving the materials that are to be used in filling them, is also various in the size and breadth, in proportion to the depth and width of the drains.

Different sorts of these Drains. Materials, and Molds of making and filling them.—These sorts of drains are sometimes open and sometimes covered, as particular circumstances may require. The former are chiefly used for intercepting and carrying off the water that descends from higher grounds, or such wetnesses as overspread the fields, in consequence of long continued falls of rain, differing more from each other in size than in the form which they may have. The latter, on the other hand, differ almost in every district, and not less in the size and form, than in the materials of which they are composed, both in this fort of draining and that of the spade kind.

These sorts of drains are formed with different materials; such as, in some cases, though rarely, with bricks, pipes, and free-stone, but frequently with land-stone, wood, loam, peat, fraw, and heath or ling; and they are occasionally simple open drains, pits, and furrows, or other such openings: both common bricks, and such as have a particular construction for the purpose, are used in these cases. Where such are moulded for the purpose are employed, when for small drains, they are often formed in the shape of an arch, and placed one by the side of the other in the bottom of the drain. But when the drains are meant to convey a considerable current of water, the bricks are sometimes made broad at the base, and to taper up on one side, as that which is placed next to the side of the drain, until it attains half the breadth of the base. This last-mentioned fort is occasionally placed in regular lines on each side of the bottom of the drain, and are covered over with broad flat pieces of stone fort of stone, and afterwards, as in every other case, the remainder of the drain or ditch is filled up with the earth which had been formerly dug out. See Spring-Drain, and Sursoil Brick-Drain.

Pipes may sometimes be employed for drains in this fort of draining; but they are not commonly used in it. In the county of Essex and some others, however, pipes of brick, about eighteen inches in length, with openings about four inches in width, are laid recoupe to, after being burnt, in forming drains for removing surface water; but they are mostly better calculated for the conveyance of the water of a small rill or spring, so as to supply a house, or other similar purpose. See Spring-Drain.

In filling up drains, where small stones collected from the adjoining lands are used, as is mostly the case in this kind of draining, as a means of preserving a passage to the water, there is no material variation in the practice of any particular district from that just given; but it appears that where bogs are formed in regard to the manner of placing these materials. They are usually thrown in, promiscuously, to the depth of about eighteen inches; and being covered with fraw, fern, or rushes, the remainder of the drain is filled up with earth. In some places, a method, which appears extremely well calculated for preventing the intermix between the stones from being choked up with earth, sand, or gravel, is adopted, that is, placing a layer of long brown rushes, &c. in the bottom of the drains before the stones are thrown in. But another method of constructing drains of this fort with stones collected from the land, is to select the largest and broadest of them, and to place them triangularwise in the bottom, leaving a small vacuity in the middle for the water to run through. When the stones best suited for the purpose are placed in the manner thus mentioned, small stones are laid over them to the usual depth, and over them again, fraw, earth, &c.

It has been stated, that there are two methods of forming surface hollow drains with stones, which are materially different from each other. The first for this purpose, where free-stone or stones from a quarry are employed, is by building two narrow walls, one on each side, in the bottom of the drain, which in such cases is made considerably wider than when land-stones only are used, and to connect these walls by a cover of stone on the top. The face of the open part of the drain, when thus finished, is about eight or ten inches in height, and fix or eight in breadth. When small land-stones can be procured, they are laid about the cover of the free-stone to the depth of 10 or 15 inches, and a layer of fraw, rush, &c. or of turf, with the green side downwards, being placed over the whole, the earth is then replaced.
The other kind of this sort of drain, which is constructed with free-stone, or those from quarries, seems extremely well adapted for the purpose of drainage, when the filterings from the subsoils, as well as the runnings, from any thing of the spring kind, require free passage. Two flat stones are placed edgewise, one edge of each coming into contact with the other at the bottom, and the others resting on the ends of the drain; on the top of which are laid horizontally other flat stones, by way of covers to them. A fort of conduit is thus formed for the water to pass in. This kind of drain is very useful in some cafes of this sort of draining, as it forms good passage for the water, and results preferrable; but it is most frequently made use of in the draining of land, where the water is caused by springs. See Spring-Drain.

It is said, that drains formed and filled with wood, are very common in Suffolk, Essex, Hampshire, and many other districts, and are constructed in the following manner. A surface-drain from 12 to 15 inches wide, is in the first place formed to the depth of 10 or 12 inches; and when the loose earth at the bottom is taken out with the common spade, the labourer, using one not exceeding three or four inches in width at top, and tapering nearly to a point at the bottom part, makes a narrow cut to the depth of six or eight inches more; and the loose soil at the bottom of the drain being taken out with a kind of scops, bent and formed for the purpose, the labour of forming the drain is completed. Then willow, thorn, or any kind of brusht, is used for the bounds of trees, &c. and planted at lengths of 12 or 15 inches, and laid to the depth of several inches, according to their strength, across the top of the small drain, and make to rest on the sides or shoulders which constituted the bottom of the larger drain before the narrow cut was made. By this means a clear passage, six or eight inches in depth, and from two to four inches wide, is left for the water. The brush-wood, being properly placed, and to a regular thickness, is covered with a layer of straw, to prevent the earth, when replaced, from falling into the gutter below. This, it is said, makes the drain a very superficial mode of draining; and when compared with drains made of stone, it no doubt is so; but it is stated as surprising, how durable, and in many instances how effectual, they are. The writer alluded to above was informed in the county of Essex, that inferences are there very common, where drains of this sort have been known to last upwards of 30 years. Much of their durability is underfoot to depend on using green new-cut wood, in place of that which had been allowed to remain so long exposed to the influence of the weather after being cut, that the natural sap is dried up. As this is a cheap, and when well executed, an effectual mode of draining, and durable beyond the period in which farmers in general acquire what may be called a permanent interest in the success of drains on any farm, it may be for the interest of those who pollute short leaves, and where stone is not to be had without an extravagant expense of carriage, to use wood, as being for that purpose next in durability to stone or brick.

Upon the subject of filling drains with wood, the following observations have been made by lord Petre: the drains filled with wood, and covered as usual with the fagots or rubes, are preferable to stones, or any other kind of materials; the reason is, as the wood decays, the water continues to pass. When filled with stones, and the drains stop up, which must be expected to take place in time, the earth becomes quite solid round the stones, and as they do not decay, the filtering of the water is for ever obstructed. Not so when bushes or wood are used; continual filtering and draining are then to be for ever perceived; and by repeating the operation a second time, cutting the drains transversely of the old ones, the benefit of the filterings through the rotten wood is secured, and the clogging or frowning up of old broken and damaged drains corrected and carried off. Moreover, as bushes form a much greater number of cavities than either stones or poles, they are less able to stop the earth; and the space left for the filterings is always kept open. A load of bushes, containing 120 fagots, will, it is thought, do about 360 rods; and a load of straw, containing 120 bottles, the same. The load of bushes is generally worth about 14s., and that of the straw 18s. per load. It is, therefore, calculated, that this expense may be about 1r. the acre, the ditches being a rod apart. And it is remarked, that Richard Preston, esq. of Blackmore, in 20 years experience, prefers black thorns to every other material for filling drains of this sort.

There is also another method, which is said, another method of filling drains with wood, which is by suspending the fagots or bushes upon crofs-billets, set on end in the bottom of the drain. This kind of drain has been successfully formed and practiced in Berwickshire, where it is said to have continued running for 30 years.

This is a kind of drain which is much recommended by the writer of the Agricultural Report of the County of Caernarthen, in Wales, who says, that the compleat method he has yet known, is to cut the strongest willows, or other aquatic brush-wood, into lengths of about 20 inches, and place them alternately in the drain, with one end on one side of the bottom, and the other leaning against the opposite side. Having placed the strongest wood in this manner, he fills the space left between them on the upper side with the small brush-wood; upon which a few rushes or straw being laid, as before mentioned, the work is done. Willow, alder, asp, or beech boughs, are exceedingly durable, if put into the drain green, or before the sap is dried; but if they are suffered to become dry, and then laid under ground, a rapid decay is the consequence. However, this form will form a secure vacancy below, and an arch capable of supporting any weight of earth necessary above.

Various methods have been devised of saving the expense of materials in the filling of drains of this sort. The sod or pipe-drains are, undoubtedly, it is said, the least expensive of any, and may be of considerable benefit on some soils; but their duration and safety in supporting heavy cattle or horses in the act of ploughing, cannot be very much depended on, unless when the opening is at a considerable depth from the surface, and when the upper mould becomes incrusted, or forms an arch, in some measure, above the open part.

The manner of forming them is by digging a trench of a certain width, to such a depth, and then by taking out the last spad with a narrow draining spade, a shoulder is left on each side, upon which a sod or turf, dug from the ground, is laid; the forward side downwards, and the mould thrown over it. It is ascertained, that such drains will continue hollow, and consequently discharge well for a great length of time. The manner of forming them, and the tools used in the work, are well described and represented in Hunter’s Georgical Essays, by a writer who has practiced the method largely.

An improved mode of cutting and forming drains of this
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set in about three inches from the left extremity of the farmer furrow; it penetrates, by means of its long coulter and increased depth, seven inches and a half below the bottom of the late made furrow, while the upper part of the plough, with its additionally attached brealt, calts the new raised earth. Several inches upon the solid unmoved ground, and a new furrow is now finally provided, which, when added to the former, of fully fifteen inches in depth, and the bottom of which is clean and clear, exactly fixes the inches wide, leaving on each side a kind of shoulder or ledge, of three inches breadth.

The whole is now ready for the land-ditch fpade, which has a sufficient length and breadth of mouth part for the ditcher to make a spit with it, of fifteen inches more in depth, and exactly in the middle of the last made furrow, by which a ledge or shoulder is left of an inch and a half on each side. This being properly cleared, a depth is ultimately gained of full thirty inches from the level of the surface of the field.

In putting in the straw or haulm, which is the next operation, it is done without any mixture or portion of wood whatever, as Mr. Taylor supposes that it generally does more harm than good, except only a very little at the sides of the croft ditches, and throughout the leading ones, which are always made several inches deeper.

The distance of the drains is varied, not only according to the several degrees of looseness and porosity of the soil, but also as there may be different degrees of declivity in the ground from ditch to ditch. In level lots of land generally a rod apart, and where there is a declivity above four yards a furder, as in the former cafes, the water mostly filtrates both ways, but in the latter only into one ditch.

There is still another manner or invention for cutting and forming the drains in the surface-draining of land, in the county of Essex, which is by means of a cutting-wheel constructed of cast-iron that has considerable weight, and is about four feet in diameter, the extreme circumference or cutting-edge of which has the thinness of half an inch, which increases in thickness towards the nave or centre, by which it will, at the depth of fifteen inches, score out or cut a drain half an inch in width at the bottom, and four inches wide at the top. The wheel is placed in a frame of wood, that it may be loaded to any weight at pleasure, and be thereby made to go to a greater or less depth in proportion as the resistence made by the ground may be more or less; parts being thus scored or cut out in the winter, the tracks or openings made by the wheel are either then filled up with straw-ropes, and lightly covered over, or left to crack and open wider and deeper during the ensuing summer by the heat. The slices are then filled with twirled straw or bushes, and covered lightly with some of the porous earth that may be most conveniently at hand. In this manner, upon graves or lay lands which are pretty free from stones, are surface or hollow drains made, it is said, at little or no expense, and which upon trial have been found to answer extremely well. This sort of wheel is flated to have cut the drains of twelve or more, and that it works or cuts best when the land is wet and soft. But no account has been given of either the expense of the wheel implement, or of the strength of draught which is required to draw it. Another more simple sort of wheel contrivance has also been made use of in Middlesex, by the writer of the account of the agriculture of that district, which has the property and advantage of making an indent in the surface of the soil sufficient for carrying off the water during the winter time, by prefling and forcing down the fward without destroying it. See Wheel-Draining.

Cesspools of forming and filling the Drains.—The expense of these kinds of drains will of course vary with the nature of the soil, depth, price of labour, &c. and these circumstances are different in different districts, and even in different parishes, that it accounts for the various reports of writers on the subject.

Duration of the Drains.—In regard to the duration of surface or hollow drains, it must necessarily depend on the nature of the materials with which they are filled, and some measure, on the quality of the soil, as certain species or kinds of land have the power of preferring wood or other perishable materials much longer than others. Stones left till accidental causes impede the flowing of the water, and may last for ever. Wood perishes in certain periods, but it is not plain that the drains should stop; if the earth arches over it, the water will necessarily continue to flow, which is found to be the case when wood, straw, and rubble are rotten and gone. Drains of this sort that have been filled with bushes and straw, both which were rotten, have been observed to run well forty years after making. As on this subject, Mr. Young, of Clare, observes, that he has never been able to ascertain the duration of the fluffy with any degree of exactness; neither has he ever drained a field in a second time; but a drain will sometimes be stopped by clay on the land of the water, some other accidental cause, in which case, as soon as it is discovered, by the wetness of the place, his practice is to make one or more fresh drains in different directions to the old ones; and he has many times observed old drains, when cut across, though there was not the least appearance of any vegetable substance remaining in them, but full of loose porous earth, it once run freely, or, according to his workmen's phrase, bleed freely. During the wet weather, about the middle of April, he examined a field of six acres, which he had drained in the month of November, a great number of years before, as above twenty; and had the satisfaction to find every drain in the field, except one, running.

Rules for marking out the Directions of the Drains.—In regard to the mode of marking out the drains, it is remarked, that for many years, probably for more than half a century, and possibly during a much longer period, farmers did not make a proper distinction in fields that had a declivity, between tracing their drains with the slope, or directing them obliquely across it. Large tracks have been drained, or have been meant to be drained, it is said, in the former way; and that many, even to this day, are guilty of the same error; but that the best farmers are now attentive to an important point, and studiously mark the direction of their drains obliquely. They are also careful to give them all the fall which is sufficient to carry off the water in a grade, but not a rapid current, by which means they are less apt to chock, or blow up, as it is sometimes called; whereby spots in the field have an artificial spring formed in them. Upon fields which are level, or nearly so, great number of which are found in the western counties of England, it has been usual and necessary, improperly done, if the wetness proceeds solely from rain, to mark the drains regularly at a rod, sixteen feet and a half, a rod and a half, or two rods a furder, across the land from ditch to ditch; or, if the drains, from any small inequality of surface, will flow only at one end, then to stop short, or discontinue their length on one side of the field, as soon as the ditch opens in laying it dry. Where the slopes of a field vary, and fall in different directions, the farmer should attend to such vari-
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tions, and directs his drains so as to cross obliquely the upper side of each declivity. It is a general rule not to conduct too many drains to the same mouth or outlet; for if much water flows in any drain, from having thrown many lateral branches into one main drain, the latter must not only be made larger and deeper, but will even then be liable to fail; and a failure in that case affects so much a large ground, by flowing the course of so many other drains. On this account it has been found better to make the drains detached, rather than to connect too many of them together, which occasions much water to be conducted to one mouth. Caves will, however, occur, in which, from the position of the ground, it may be found necessary to join several branches (wings) into one main drain. On this subject, Mr. Vancouver, in the Agricultural Report of the County of Eliza, has the following judicious remark. If the field proposed to be drained lies greatly upon the deficient, every care should be taken to make the drains bear sufficiently horizontally; in the first place, to prevent a too precipitant fall of the water, by which the bottoms of the drains would be worn uneven, and a temporary obstruction occasion them to blow up; and secondly, because the more perfectly horizontal the field is, so that it lie level, free, and afford a sufficient fall for the water, the less occasion will there be for the same number of drains as would be required upon a soil of equal closeness upon the side of a hill, the drains in the field that lie nearly level, drawing equally well on each side; whereas those on the bank of a hill, drawing only from the higher sides of the drains, consequently require them to be made much nearer or closer together.

The proper Season for performing the Work. — And in respect to the season for executing the business of cutting these kinds of drains, it is a point on which opinions, it is observed, vary considerably; some preferring winter, and others summer. When a great quantity of work is to be done, all seasons of the year, free from sharp frosts, must be made use of; and this is usually the case when a farmer enters on a lease to a farm which has not been drained, or which requires to be done a second time. Stubbles are usually done in the winter, and fallows in the summer season: but when a single field or two are only to be done, the farmer may choose the most convenient season for the business. Many excellent farmers would not do it at any other time than summer, from being then able to execute the cuts in a cleaner and neater manner, and fewer from that kneading and paltering which takes place in winter, and which they think tends to prevent the flowing of the water from those minute and imperceptible veins and interstices of the soil through which the water percolates. They have farther remarked, that opening the earth in a dry season gives a tendency to drain it, as the particles of the soil, after being separated and well dried, will not so easily unite again; whereas the kneading in winter tends to increase tenacity where it is moist to be avoided. Further, that carting on the fields in winter, to bring on stones or other materials, is more difficult and dangerous than in summer. In opposition, however, to these ideas, Mr. Young, of Clare, in Suffolk, it is remarked, is of a contrary opinion. He says, in summer: two inconveniences attend it; the increase of labour, in a clayey soil, when hard and dry, is very considerable, and the want of leisure, and when good labourers are scarce. Lord Petre on this observes, that the plough for opening the previous furrows, works better on a layer. He prefers a lay, if lowed down level, as he has a plough on a very simple construction, with which, and fix bories, he can plough from ten to twelve inches deep, and lay the furrows as regular as a man can with a spade; so that after the drain or ditch is digged and filled, the furrow can be put into its place again, and rolled down with a large roller quite level; and then he digs but one spit with the bottom land-ditching spade fourteen inches deep: the expense 2s. 8d. per twenty rods, the digger returning the furrows to its place. He also uses this plough on fallow, but it does not answer so well, as the moulds fall into the furrows. The expense of digging on fallow is 1s. 2d. the rod.

When the ground is in summer fallow it is certainly the best time for calling drains that are only for carrying off surface water, as the diminution betwixt the wet and dry parts of the field is then the most easily perceptible, and any prominent inequalities of surface may then be more easily levelled or reduced, by paring off the heights and adding to the hollows.

Various seditions, representing the manner in which these different sorts of surface-drains are made, as well as the several different kinds of bricks, tools, ploughs, and other contrivances which are employed in forming them, and which have been described under their proper heads, may be seen in the first volume of the "General Dictionary of Agriculture and Husbandry."

SURFACE Mole-Drain, a small sort of pipe-like drain, made by an implement for the purpose, a foot or more beneath the surface, by means of a thick iron spike, pin, or bolt, drawn along horizontally, at that depth. It is supposed, that for cold retentive grists-lands, which lie too flat and swampy to shoot off readily their surface waters, and which are free from stones, the mole-plough drains will perhaps be found of general benefit; but most especially, Mr. Marshall conceives, for moist sheep pastures. There is much merit in the thought of making them in this way; and, it is said, the construction is beautifully simple. The great strength and weight of draught which are required to work the tool appears, from what he has seen of it, to be the principal objection to its use in forming them. This has, however, been lately, in some measure, obviated by working the tool by means of a sort of windlass turned by women; and by the use of a lever of a one or two-horse power, ingeniously contrived for the purpose. See Mole-Plough and Surface-Drain.

SURFACE Open Drain, such a drain as is not closed on the upper part. It includes surface-drains of all kinds, from the inter-furrows of land under the plough, and the shallow trenches or cuts of meadow and grazing grounds, to the common sewers, or discharging channels of the higher lands, and the more insignificant ditches, or furrows, of low countries. This sort of drain is mostly proper for conveying rain-waters from the surfaces they fall upon, to their natural receptacles. But in taking off water from beneath the soil, they cannot be properly made use of in any other way than as main drains, to convey away the stream that may be collected. Mr. Marshall remarks, that operative drains, if cut to a sufficient depth across the area of a field, to draw out superfusious moisture properly from the soil, cannot be left open with any degree of propriety. When water issues, the subfrazmum is naturally looie, and liable to shoot into open trenches, which are likewise exposed to the tread of cattle; so that even in grists-lands they are ineligible, and still more impracticable, it is said, in lands under tillage. Even main drains, if carried across loose ground, require to be fenced on one side, or to be made wide and deep enough to prevent cattle from crossing them. It has been noticed by the writer of the corrected Report of the Agriculture of Berkshire, that the work of
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Making or cutting open drains and grips for taking away surface water, may be performed, in some cases, by the plough, though, in general, manual labour is necessary for the purpose. And that, in meadows and other low and wet situations, great attention should be paid to the surface open drains and ditches, which though the expense in his cleaning and scouring them out every year be not inconsiderable, there may be some recompense in the mud and soil which are thrown and got out of them. See SurFace-Drain.

Surface-Draining, that sort of drainage which is intended to remove the prejudicial wetness that is contained in or upon the superficial parts of the land or soils. It is evident, it is said, by the writer of the work on the improved principles and practices of draining land, that the Romans were not unacquainted with most of the modern methods of surface or hollow-draining, as appears from all their writers de re rustica, as Cato, Palladius, Columella, and Pliny, mention them particularly, and describe some circumstances which have lately been considered as modern improvements. Several circumstances are alleged, which have been thought sufficient to prove, that the Romans understood the business of common draining in great perfection, and that our best cultivated counties had little to boast of in this respect, in superiority to the ancients, until Mr. Elstington and others made the discovery of a method with which they were wholly unacquainted. The best French writer on agriculture, De Servès, who wrote in 1660 his Théâtre d’Agriculture, describes, it is said, surface or hollow drains particularly; they were filled with stones. In Dickson’s Husbandry of the Ancients, vol. i. p. 358, the passages alluded to above are put down and translated, as may be seen by the inquirer on this subject.

It is not easy to ascertain when this practice was first introduced into this country; some have thought, from a circumstance that occurred in Suffolk, that under-ground draining was practised three hundred years ago in this kingdom. We find also, it is said, that alder is of all other wood the best for filling drains. Probably no other, except that of aquatic plants, would endure nearly so long. Bulbs, as has been seen, are generally used, but sallow or willow is probably much better. The Board of Agriculture has, however, been informed by Richard Prefont, esq., that land drained according to the prefect practice of surface-draining, is not more than forty years flading great; for the upper stratum, where the moisture is chiefly lodged, being in some degree porous, the water is easily extricated from it by means of the drains. The under-stratum being also of a retentive quality, their depth does not require to be great. It is noticed, that when Mr. Young of Clare, who has had great experience in this mode of surface or hollow-draining land, observes that the improvement made by these drains, and this kind of drainage, is great on clay soils, he certainly means soils of this description or quality. That able farmer, that he knows from experience, that in “clayey soils it will answer perfectly; that it is the least expensive, and the most expeditious, as well as most durable improvement of any in the whole system of agricultural economy.”

In a soil also of a thin, black, moorish quality, relying upon a retentive till bottom, which in the winter falls when pulverized by frothing during wet times, afforded not any fort of resistance to the foot of the plough, on which instantly plumped down to the subsoil; and which, even when in pasture, and the surface firm’d by a few wind, was extremely subject to poach at the former taste; and in which, upon the second or third year of plantings,
the furrows between the ridges used to be completely grown up with rushes: this mode of draining has been introduced and employed, it is said, with the most complete success, by sir George Montgomery of Magbiehill, in his parks at Sunny-side, in Newland parish, in Scotland. It is flatted by the writer of the Agricultural Report of the County of Peebles, that in an hour or two after the heaviest rains, a horse may now gallop over this land, without almost leaving the impression of his feet; and that the rushes, which were beginning to take possession of the furrows, have literally all perished for want of moisture. Such a total change of the nature of any soil has indeed never been observed by the writer.

Equal advantages may probably arise from this sort of surface-draining, in many other cases and kinds of soil. The most common modes and cafes of surface-draining are those which are given below.

Drainage of Land, where the Soil is porous above and retentive below, &c.—It has been remarked by the writer of the Account of the Principles and Practices of draining Land, that in flat tracts of land, where the surface or upper soil is injured by a superfluity of stagnant water, not proceeding from springs, their drainage is an object of the first importance, and which, in moist cafes, be accomplished with very little expense. The upper soil being composed of a porous stratum of two, three, or four feet in thicknes, and having under this a strong retentive body of clay, the rain-water falling on the surface is rapidly drained. All it meets the clay; and there being obstructed from farther decr, the whole open part of the soil stands full of water, to retard the progress of vegetation, or at least greatly to injure it. This kind of soil is commonly denominated wet-bottomed land. To carry off this water requires only, it is said, one or a few drains, according to the situation of the field; and these no deeper than just to reach a few inches into the clay, betwixt which and the under part of the porous soil the greatest quantity of water will remain stagnant, when it does not appear to much on the surface. In this kind of drainage there is no need for the auger, there being no real spring or subterranean water to get rid of, but merely that which stagnates, and is retained in the superficial parts of the soil. If the field or ground to be drained should have a small descen from both sides, one drain cut through the porous to the clay soil, in the hollow part of the land, will effectually draw off all the water that the porous soil may contain; which will be greatly facilitated by properly forming the ridges to answer the declivity of the ground, and by deepening and clearing out the furrows with the spade. Where the situation of the ground or field corresponds with the above, the water will flow into the drain, as being made in the hollow part of it; through the porous strata, as well as through a number of small trenches cut up from it to both sides, which is the common practice in Effex, and some other counties adjoining: and, from its being so much practised there, is commonly called the Effex mode of hollow-draining. But it is, it is said, cutting up a whole field to no useful purpose. The drain, in such a cafe, may either be open, if it can serve as a division of the ground or field at the face of it; or closed, as circumstances may require. If the ground, or a field of this soil, has more than one hollow in it, in that case it is necessary to have more than one drain; but if it is almost level, or inclines only a little to one side, a ditch or drain at the lowest extremity, having the ridges and furrows properly formed, will answer the purpose effectually. In some cafes, however, it may be necessary to have a few side-cuts from the main drain, where the field is large or very flat, cut down also a little into the clay, as narrow as it is possible to dig them, and filled with stones in the usual manner. Such is the method of draining these sorts of soils with most advantage; but many fields suffer equally from wetness, that consist of a soil exactly opposite to the former in its nature, namely, a clay surface, having a porous sub-stratum. The drainage of such ground, where the wetness is little or more injurious nature, and where the impermeability of the soil that holds the water is of such a thickness as to require being perforated by the auger, has been already fully described in speaking of Spring-Draining (which fee); but here the depth of the drain being sufficient to reach the porous subsoil, without the help of boring, the description of such may with more propriety be introduced under this head. Fields or grounds of this kind commonly lie very flat, without any declivity, whereby the noxious water, stagnant on the clay-surface, might naturally discharge itself without the help of drains; for soils of the same nature, in a hanging situation, are seldom or never affected by the same cause. Such ground is more difficult to drain, and requires a greater number of cuts than any other soil whatever; as they must be laid out and conducted as to collect all the water from the surface, which can only discharge itself into the drains from above, being unable to flow into them through the clay: as in those soils of an opposite description, and where there is any irregularity in the grounds, the water will remain standing in the hollows within a few feet of the drains. The first thing in all stone cafes, is to make one main conductor in the lowest part, or at one end of the field, to receive and carry off the water collected by the smaller collateral cuts, which it may be requisite to make on each side of it. If it suits the situation or division of the field, this main drain had better be open than covered, and then the outlets of the other drains that fall into it can easily be inspected, and frequently cleared out, as occasion may require.

The proper formation of the ridges, to answer the declivity of the ground, should also be particularly attended to in such soils. The ridges should have rife enough in the middle to give the water a fall into the furrows, and these should have depth and fall enough to convey it into the drains. Thus would a great part of the rain-water, as it falls, be carried off, which would lessen the number of small cuts, otherwise necessary. The drains should all be dug as narrow as possible, and filled up in the usual manner with loose stones; only the bottom of the conducting drain, if it be not an open one, should be formed in the manner already described, with a small open conduit at bottom, the more easily to carry off the water. The small drains should also be coupled at bottom, or have two of the largest stones laid in the bottom, inclining on or against one another, so as to form a triangular opening of four or five inches below, in the way that has been described more fully in speaking of surface-drain. As the water is all received in at the top of these drains, it is necessary that they should be filled with small stones so near to the surface, as to leave only a space to be filled with loose gravel, sufficiently deep to prevent the plough or harrow from deranging them. Loose gravel, being so loose, as the wind and frost will turnout of the drain, as it more easily admits the water to be absorbed and pas through it into the stones, and the other can be spread on any adjacent hollow in the field. A thin layer of straw or rushes, or, if the field be in pasture, the upper turfs pared thinly off will answer this purpose better than straw or rushes, should be laid immediately above the stones, to prevent the smaller part of the gravel from filling up too closely the interfaces between them; but this is not so re-
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quite, when gravel is used in place of the mould. This mode of draining is calculated for very tenacious clay soil, whether porous below or not; but in many instances, the deepening of the furrows, with very few drains, might remedy the evil, where the retentive upper soil is only a foot or two deep, with a porous subsoil under it, through which the water would easily subside downwards, and again empty itself at some lower extremity of the field. The drains and furrows should, therefore, be deepened through the clay to the open soil, in order to facilitate the descent of the water; and thus much depends on the proper ploughing of such ground, by attention to which, many drains, otherwise necessary, might be dispensed with. The mode of draining these soils, which has been described, is that which has been recommended as the most effectual by Mr. Elkington, though it does not properly belong to his system of practice in the art.

The Essex mode of executing the drainage in ploughed spongy lands, where the surface soil is tenacious, as stated by Mr. Kent, is somewhat in these ways. Where the principal declination of the land is in the middle of the field or ground, it may often be drained by one main drain made there to a proper depth. In other cases, the ground, or a field, may be divided into the means of one of its directions in the room of a main drain. In still others, a field may be drained by a main drain cut in the middle, declining more at that part than the sides. And, lastly, a field may be drained by two outside main drains, the land being higher in the middle than on the sides.

Drainage of surface Water draining on Land of the moorish marsh kind, near the Sea, by artificial Means.—A great variety of drainages of this nature, of more or less extent, has lately been effected in several different parts of the kingdom, by drains. The mode of this sort; and some highly interesting improvements, accomplished by this mode of draining, in land of the above sort near the sea, have been executed, within these few years, in the county of Cornwall, and described in the Report of the State of the Agriculture of that district. It is stated, that great exertions have been there made in the mode of removing the wetness, recovering, and improving land, which for ages had not only been unprofitable, but dangerous, in consequence of confined and pent-up waters in it. At Trewarthnicken, the feat of Francis Gregor, Esq., a moor, of previously no value, it is said, may be drained of the means of one of its directions in the room of a main drain, which, will be converted into the finest meadow ground by a spirited attempt of this kind; a great part of which was then planted with potatoes, which promised well. This moor, it is noticed, was in a state of which none but an inhabitant of this county can form any idea. It had been formerly strewed for tin, which is searching for granules of it that lie in horizontal strata, from one hundred feet below the surface. The tin, intermixed with the gravel, is washed in a stream of water carried through the work, and then separated from all impurities, and becomes strewing. The old land of the stream-works was left in the above devasfted condition. By this strewing operation, the superficial soil had, it is said, been turned under and buried, and the subsoil and gravel heaped upon it in large irregular mounds. In this state, fedges, ruthes, furze, and fatted brash-wood, wholly occupied it; and after many attempts to reclaim it, the farmer had relinquished it to the sportman: besides, the river frequently overflowed its banks, and deluged the lower parts of it. The successful mode of draining and crop management was, after clearing away the surface-obstructing matters, draining, and preventing its being again overflowed, by bringing up levels from high-water mark through the bed of the river, by levelling, and the cultivation of proper crops as those of potatoes, fennel, &c. On the opposite side, a further improvement of the same kind was carried on: the river, which is at all times foul, but particularly so after heavy rain, was ponded back in such a manner, as that the upper surface of the river-water was permitted to flow over the land. The deposit made in this way confined, it is said, of the lighter particles; the heavier ones, particularly the gravel, linking lower in the ponded water. By this means, in no great length of time, a new surface soil is capable of being formed, and afterwards thickened at pleasure in the above manner. The bringing of this surface kind having been well performed.

The plan of drainage given below is that which has been practised with success by Mr. Moyle, of Marazion, in the same county, on a large tract of land overflowed by the sea. It is remarked, that in all those situations where lakes are formed near the sea, having access to them at springs, it is impossible to effect a drainage by the ordinary modes, from the want of levels; and, of course, such pieces of land, from being contantly covered with water, become unprofitable to the proprietors, and offensive to the public, by producing diseases. Several marshes, and some small lakes in the above country, fall under this description, and have been looked upon as irreclaimable, on account of the sea, at spring-tides, being several feet higher than the land; so that no levels, by the common modes of draining, can be procured to carry away the internal and surface waters. Purchasing an estate near the above town in 1799, where a piece of land of about thirty-fix acres was contantly covered with water, and overflowed at spring-tides, so as to leave about two feet of water over its surface, the above gentleman was induced to try an experiment of draining this land, by opening a sluice or drain about eight feet below the level of the sea, at high water, which, though numerous obstacles prevented themselves to the completion of the scheme, he perfected; and the land, already cultivated, is become of considerable value, from the production of oats and pasture for live-stock.

It is stated that, previous to the commencement of such an undertaking, it is necessary to form an accurate idea of the probable quantity of water which may be furnished by the under or internal and rain-water; for that a pipe of sufficient size may be provided to discharge both, and to render the surface completely dry, previous to any agricultural operations.

This marsh is situated in the parish of Ludgvan, about a mile from Marazion, and contains about thirty-fix acres: it exposes its fourth side, of fix hundred and thirty yards, towards the sea, from which it is separated by a large body of land, of one hundred and seventy-four yards, over which the road leading to Penzance parishes, and which serves as a natural embankment against the sea. On taking an accurate survey of the levels from the sea, at the point of half ebb, the surface of the ground in the marsh, being a distance of one hundred and seventy-four yards, it was found that fixed feet of levels could be gained, after allowing two feet for the run or flowing of the water.

As to the drainage, this was effected by means of a square wooden pipe of nine inches diameter, introduced from the point of half ebb through the sandy embankment, till it arrived at the marsh. This arduous and difficult undertaking was performed by throwing open the bank by a number of workmen, nearly at the level of half ebb, so as to give the pipe a very gentle elevation, of about fifteen inches to every hundred yards, as it approached the marsh. The two first pipes
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pipes were secured by large rocks or stones, to prevent them from swimming; and the others were successively joined, each pipe measuring about twelve feet in length, and the wood an inch and a half thick. The deepest part of this land was about twenty-four feet above the pipes, so that the difficulty of getting to a sufficient depth in this place became very great, as the land was apt to run on the workmen, and required the opening on the surface to be forty feet. As the work was approached, the depth of land became gradually less, so that there was introduced a reference about sixty feet under the surface of the land. The aperture of the first pipe in the sea had iron bars placed before it, to prevent the infestation of sea-weeds, &c. and also a valve, made of strong wood, hung with leather, and loaded with a plate of iron, to prevent it from swimming at the approach of the tides, which shuts it cloe as effectually to exclude the sea-water, which, at high spring, is about nine or ten feet above the pipe. There is also another valve in the last pipe, near the refferoir, to affit the total exclusion of the sea, in case of any accident happening to the other valve. The pipe from which projects a few feet into the refferoir, is considerably larger than the rest; and bars of oak of an inch square are placed upright, to exclude any extraneous body from getting into the drain; it was found necessary, too, to add a short piece to the sea-pipe, about a foot and a half long, to prevent the intrusion of pebbles between the valve and the pipe, which might obstruct its closely shutting: some little difficulty likewise arose from the confined air in the pipe, at the approach of the tide, but this was removed by introducing an extra small pipe, of about an inch and a half diameter, through the cover of the pipe nearest the refferoir, so as to carry away the air confined between the two valleys, at the approach of the sea, which prevented the discharge of the marsh water till the return of the tide, during which time the water accumulates in the refferoir and trenches to the height of three feet. These pipes were square, and made of bark an inch and half thick, and secured together by oak pins instead of nails, which would soon decay in saltwater; but the writer would recommend circular pipes of elm, which, from their shape, are not so liable to be injured by the tides.

In regard to the refferoir, it is eighteen feet square and eight feet deep, from which, on each side, a main drain or trench is carried to the extremity of the marsh on its south side, whilst other trenches, running north the whole length of the marsh, at the distance of one hundred and twenty yards, discharge their water into the main drain, so as to divide the whole into fields, which are subdivided into ridges of nine feet wide, across which, at the distance of every twenty-five yards, is a furrow, to collect and convey the surface water into the long trenches, so as to keep the whole completely dry. The main drains are from fix to four feet deep, five feet wide at top, and two feet and a half at the bottom. The substance of this marshy ground, to the depth of fix feet, is of a peaty kind, mixed with a muddy sediment; below this is a stratum of sand about five feet deep, which carries evident marks of its being the bed of the sea, of a very ancient date, and which has been gradually excluded by the accumulation of a muddy sediment, and the dropping of the leaves of aquatic plants, which united, it is said, form pent-mops. And as soon as the drainage, in this case, was effected, a strong embankment of turf or sod was made around the marsh, so as to prevent the river, surrounding its two sides, from overflowing the land, and through which river the sea flowed at spring-tides. The danger arising from the approach of the sea was also prevented by a flood-gate, placed in a narrow part of the river, which always shut by the coming in of the tide, and opened again on its return.

In further reclaiming the land, in this case, as soon as it was completely drained, and became firm, it was, it is said, frequently ploughed, harrowed, and burned, so as to pulverize it: large bodies of clay, sand, and manure, were carted on the same; but the saltness of the soil, from its being covered with the sea for ages, prevented any crops from springing for the first three years, after which it was repeatedly covered with fresh water, which, so as to destroy the soil, by disolving the saline particles, that crops grew in great perfection on the fourth year. Thus much useful land was well drained, and brought into profitable cultivation from the state of absolute waste, without any very great expense in any way. There can be little doubt but that this artificial plan of drainage might be had recourse to in many other similar situations with equal success and improvement. And in different moory and marshy tracts which are not so greatly overflowed by sea-water, something of the plan might often be adopted and practiced with great propriety and benefit, in removing the wetlands which is so injurious by flagrating and reftting in and upon them.

Drainage of Land, where the Soils are wholly of a clayey Nature, and much injured by Surface Water, or Wetness.——The drainage of clayey soils of this nature is probably the most difficult and troublesome of any in the whole practice of surface-draining, as from the nature of their stiff component materials, the wetness is drawn off to only a very small extent, or dilution, from any drains that may be formed in such lands, much cutting of the surface is, of course, unavoidably necessary for draining but small or trifling extents of ground. Something may, however, be done, and some advantages gained, by giving the drains a suitable form and direction, according to the different nature of the situations of the lands, and by running them sufficiently near to each other. However, in tillage lands, more often depends, in these cafes, as will be afterwards seen, upon a due form being given to the ridges, and the furrows being made to act well as drains, than upon any number of covered drains that may be formed in them, though attention should, in most instances, be paid to both practices. It is found, in very many soils of this nature, where the drains in this fort of drainage are carried in the same direction as that of the declivities of the fields, or somewhat straight up and down, then they will draw the water or moisture laterally, in some measure, to the distance of about two yards from their different sides, and consequently that they should be formed in a parallel manner to each other at about every four yards distance; but where the surface ridges and furrows are properly prepared at the same time, they may have a somewhat greater pace between them. They should never have more declivity given them than what is just necessary to cause a very gentle run or passage to the water. In the draining of clay soils wet from rain or surface water, but in which the upper surface part above the clay was from four to eight or ten inches in depth, and of a good quality, only lying in a mountainous part of the country, near to the sea, a great deal of rain fell upon it, which always kept the upper soil full of water, and produced a very coarse sort of grass, not worth more than three shillings the acre, when the land was in that state, and in which the under stratum of clay was of very great depth: Sir Henry Fletcher had recourse to a hollow coupled stone method, which has been described in speaking of surface-drains, with great success. He, however, first tried and pursued a mode which was the common one of the country, but which was found too expensive: the drains in it were made from twenty inches to two feet wide.
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wide and deep, square, and filled up promiscuously with quarried flones to within nine inches of the surface. The quantity of flones required in this way was so great, that the quarrying and dilant cartage came abundantly too high; so that the whole of the expense did not amount to less than three-pence halfpenny or four-pence the yard, and by the acre to ten pounds. In order to lessen so heavy an expense, he changed the method to that which has been alluded to, which is found to be cheap and effectual.

These, though not the exact sorts of clayey foils which are comprehended under the above head, the mode of draining employed in them may, probably, be found to answer well and cheaply, in many cases, of all the kinds. Besides, it is always a neat and simple, as well as a convenient method, in some situations, both in arable and grafts lands.

In draining the clofe, retentive, red, toagh, clay foxes in different places in the county of Essex, it is found necessary that the surface hollow drains should be made within ten or twelve feet of each other. They are commonly formed by the plough and the spade, as shewn under the head surface-drain, to the depth of twenty inches from the surface, and are left one inch in width at the part is in the higher portion of it filled with straw alone. Thofe leading to the outfalls are usually made about eight inches deeper than the lateral ones, and have elm-wood used with the straw in filling them. It is said that the whole, upon a fair trial, has been found to answer inimitably well.

The retentive compact clays lying upon a red rough clay, or tile-earth, in other places, have, however, been surface hollow-drained at a pole apart, at the expense of not less than a guinea the acre, but without the effect in any way equal to or above those formed by the means that are at present employed for relieving the land of its surface water, are, it is said, the use of the surface land-fall plough, and water-furring; but though these operations are performed in the best manner, the land is still left latured with water, and is much later in the seed-time and harvest than the neighbouring places. See Surface Land-Fall Plough.

In other cases, upon chalky and wet rough clays, as well as other sorts, the practice of surface hollow-draining has effected considerable improvements in the lands of the same districts.

In all foils of this clayey fort, when the lands are in the tillage state, whenever it is convenient, every opportunity should be taken of applying and incorporating different suitable earthy and other materials to and with them, in order that they may, as soon as possible, be in a proper drainable condition.

Drainage of Land where the Soil is stiff and retentive, by means of open Cuts, and the proper Formation of Ridge and Furrow.—It has already been hinted, that on some soils, where the surface is very retentive, no number of covered drains can operate effectually in drying the ground. It is ascertained, that in most of the central counties of England, and also in Flanders, the general mode of drying land is by ploughing it up into high and broad ridges, from twenty to thirty, and even forty feet wide, with the centre or crown three or four feet higher than the furrows. The successful practice of the Flemings shews clearly, it is thought, how effective this method is when well executed; for by attentively keeping the furrows perfectly free from water, the land is kept in so dry a state, that all sorts of crops flourish remarkably well. But in England the same observation would not be just, for want of the same attention to this mode of practice. In many instances, furrows are not properly directed, nor properly deepened, and the ridges are

too flat; by which the water flagellates in the hollow and, of course, renders that part of the field worse than lost. This bad management, it is thought, has brought the method itself into such discredit, that in many places they have been levelling their ridges at a considerable expense, in order to adopt some other method of draining, an operation which, on clayey foils, is certainly very imprudent; for when the ridges are well rounded, not too high, and the furrows kept open, and perfectly free from retaining water, it must be esteemed, for land of a very retentive surface, an excellent mode of draining, or keeping it dry. Water-furrowing is attended with very beneficial consequences, it is said, when performed in a proper manner, and at those seasons when the land requires it. It is likewise very simple in its nature; but the omission of it may be attended with the loss of a part of the crop, of whatever kind it may be; and the wetness in the land may often be removed by that means, without the aid of drains.

Much, it is remarked, has been written against high ridges, but not with due consideration of their propriety on such land; they have been applied on dry loams with advantage, and have been successful; and from latter parts of the country, no discrimination has been made: but their being improper in some cases, and ill-managed in others, certainly affords no just argument against them, when well adapted to the nature of the soil, and wetness of the climate.

The mode of ridging and cross-through, or, as it is usually called, furrowing land, as practised in the county of Gower, in Perthsire, is described in the following manner by George Paterfon, esq. of Castle Huntly, in that county. As clay is perfectly impervious to water, surface-draining is the only means by which that species of foot of improvement can be accomplished; and all over the county of Gower this operation is said to be extremely simple. There are certain large common drains, which pass through the district in different directions, sufficiently copious to receive the water drained from the fields by the ditches which furrow them, and of such a level as to carry it clear off, and empty their contents into the river Tay. There are also ditches which furrow every farm, or pass through them, in such a manner as to communicate with every field upon the farm. These ditches are made from two to four feet wide at top, and from one and a half to one foot at bottom, in a shape which prevents their sides from falling in; but even then they must be cleaned, and scour out every year at a considerable expense. If the fields be of an uniform level surface, the common furrows between the ridges, provided they be sufficiently deepened, will serve to lay the grounds dry; but seldom happens that any field is so completely free of inequalities, the laft operation, after it is sown and harrowed in, is to draw a furrow with the plough through every hollow in the field, which may lie in such a direction, that it can be guided through them, so as to make a free communication with any of the ditches which furrow the farm, or with any of the furrows between the ridges, which may serve as a conductor to carry the water off to the surrounding ditches. When this track is once opened with the plough, it is widened, cleared out, and so shaped with the spade, that it may run no risk of filling up. Its width is from six inches to two feet, according to its depth, which must depend upon the level of the field; but the breadth of a spade at bottom is a good general rule. It frequently happens that there are inequalities in several parts of the same field, which do not extend across it, or which do not pass through it in any direction that a plough can follow, but which may extend over two ridges, or one ridge, or even a part of a ridge: such re-
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quite an open communication to be made with any furrow which may serve as a conductor to carry off the water, which are always made with the spade. All these open communications are here called gaud, and to keep them perfectly clear, is a very essential part of every carle-farmer’s attention.

It may be observed, that on some need-paitures, the carrying off surface water may be effected in the simplest manner of forming drains that has been already noticed in speaking of Surface-Drains; which fee.

It may be stated, in conclusion, upon this very interesting point of management, that even the ancient Romans were sensible that wet land was fit neither for being ploughed, harrowed, nor planted, as Columella has observed: "Ne lutoos aegor tractatur—nam quae limosa verantur arva tota anno deinum pollre tractari, nec fung habilia fomenti, aut oxidationi utatione." Col. lib. ii. cap. iv.

Surface-Draining Level, that sort of implement of this kind which is used in draining land. There are several kinds of levels employed in this sort of work; as the common draining-level, the American draining-level, and the spirit draining-level: all of which may be found useful, in different cafes, in both forts of draining. See Level.

Surface-Draining Mill, that sort of mill which is constructed wholly for the purpose of raising or lifting water, so as to draw and drain it off from the surface or other parts of land. Where the quantity of water to be raised is considerable, and the depth at which it lies is not more than a few feet from the surface, as from five or six or eight, the common draining-mill of the marsh-land district may, it is said, be employed to force up the water into an open drain or cut, which is sunk to about half the depth for receiving it, with great convenience and utility. But in cafes where the depth of the water is still more considerable, and the covering materials of it of loof and mouldering a nature as not to admit of deep open cuts, and arched work being of too great an expense, pumps going by wind or water may answer the intention more cheaply and effectually.

Surface-draining mills of this kind are not unfrequently useful and necessary in level marhs and other tracts of land, where the water can neither be removed by the use of the deep-cut trenches nor the boring auger. Surface-Draining Plough, a sort of plough which is contrived for the purpose of cutting drains in land, in order to carry off the water from the superficial parts of wet foils. Various implements of this kind have been invented at different times for performing the necessary operations of draining; but perhaps none have yet been found sufficiently to answer the intention in all the varieties of soil on which they may be required. A plough of this sort, which was long since invented by Mr. Cuthbert Clarke, of Belford, in Northumberland, was found to answer exceedingly well in meadow ground, but could not be drawn in a stiff clay with the force or power of eight horses. It has of course long ago been wholly laid aside, but it might probably be so altered and improved, as to be made a good tool for the purpose in some cafes. It may be observed, that the mode of operation in this draining-plough is nearly the same as that with the common plough. But it would seem, that as the angle of the break part is greater than that by which the horses draw upwards, it must have too great a tendency to get into the earth; the consequence of which is, that when the soil is very stiff, it requires a great force to draw it, and cannot be held down properly by the handles. By the angle of the break part being therefore lefened to about thirty-three degrees, it is not improbable but that it would, in a great measure, remove this difficulty. In marly, boggy, and moosy foils, it is said to answer the intention extremely well, and to make a clean trench, working very well. From its requiring a great deal of strength of draught, it can, however, only be employed in particular cafes with convenience or success.

About twenty years ago, a bounty was also given by the Society of Arts to Mr. Makins, of Suffolk, for having invented a plough of this sort for cutting hollow drains. But though the tool, and notion of constructing it, were not without merit, the implement has long since been laid aside, both in the above county and in that of Essex. Afterwards another plough of this sort, for the same purpose, was invented by Mr. Arbutthnot, of Mitcham, in Surrey, which is described and represented in Young’s "Eastern Tour."

And more lately different trials, for forming drains of this sort, have been made with variously contrived tools of the mole-plough kind, which by forcing a pointed circular iron part or mole through the earth or ground, at a given depth, by means of a strong power of draught, a pipe-opening is formed in it, which is not to be filled with any fort of materials, but left open, so that the water may flow freely through the parts of the soil it has loosened, to a proper depth, and the roots of the grain or grass crops, and find its way by filtration into the furrows, as has been proved to be the case, it is said, by experience. Different improved implements of this sort have been contrived within these few years, which are said to answer the purpose of taking off the surface wetness of land in a very effectual manner. See Surface Mole-Drain.

It is thought imprudent by the writer of the work on the Principles and Practices of draining Land, where the wetness is caused by springs, to too readily suppose a limit to human invention; but it may be stated, that the probability of an effete or hollow draining-plough being invented, which will work so much cheaper than the spade, as to become an object of economy, is by no means flattering: none which have hitherto been tried seem, it is said, to fully and completely answer this intention; but there can be no sort of difficulty in making one to open and prepare the ground for the narrow drain-spade to make one slit at the bottom. The repeated ploughings or shovellings which are necessary with common tools are expensive, and might probably, it is supposed, be executed in a cheaper and more expeditious manner by a surface open-drain plough. How far that invented by Mr. Knowles, and rewarded by the Society of Arts, would at a sufficiently cheap rate answer this purpose, has not yet been fully and properly ascertained. But it is thought obvious, that from the force and number of horses or oxen which are requisite to work them, ploughs calculated for this use will never come into general employment.

The surface common draining-plough is likewise a plough of this kind, which is employed, in some of the midland counties, for the more general purposes of surface-draining, and which is a good and not very expensive tool. There is a draining plough of this sort, too, made use of in Leicestershire, with advantage in different cafes and sorts of land.

Surface-Draining Furrow-Plough, a plough of this clafs, which may be employed for making large open furrows, by which the water may be taken off from the surface of the land. It will be frequently found a necessary tool in those clayey soils where water magester on the surface of the ground, and which cannot be removed by the more general modes of surface or hollow-draining; a plough of this kind, employed for opening the furrows on tillage-lands in some district.
difficulties, is said to be a very useful implement. It is constructed with two mould-boards, which can be regulated and set off to different distances, so as to make wider or narrower water-furrows, as the nature and circumstances of the lands may be. It is also contrived so as to work to greater or lesser depths, as may be necessary. By these different means, water-furrows of very different sizes are capable of being formed by the same plough, which is a matter of much utility and advantage in different cases, and which saves a great deal of expense in many instances.

Surface-DRAINING Gutter-Plough, is a plough of the draining kind, made use of for forming gutter-drains in grass-lands. A plough of this nature has been lately recommended by the duke of Bridgewater, and which is said to have been found useful in forming gutter-drains on grass-lands, where the soils are of a retentive nature. The power of six horses is, however, required in drawing it in soils that have not been drained before; but in opening the old gutters, four horses are found sufficient for effecting the purpose. This great power of draught in all ploughs of this kind is a great objection against them, and greatly prevents their utility in different instances of this fort of drainage.

Surface Land-Fall Plough, a particular sort of plough made use of in some parts of Essex, it is said, with advantage, where the nature of the under-frates, in a great measure, forbids a regular and even course of hollow or surface-draining; and which acts or operates in bringing the land or field to a more uniform level, by filling up the small hollows with the earth which is removed from the unequal or higher parts of the grounds, by which means any open drains that may be necessary may be cut or formed upon a more evenly inclined plain, and the surface water be carried or taken away with a greater and more regular certainty: the earth or land, however, in these cases, it is suggested, from the want of proper hollow-surface-drains, is still liable to retain a considerable quantity of water, which not frequently perishes the seed which has been sown; and by the chill which it produces, even in the most favourable seasons, greatly retards and prevents the powers of vegetation. See Water-Furrowing.

The plough is constructed in a sort of box-like form, open in the front, but closed on the sides, and made so as to slant off levels, and reduce the inequalities of the land of the ridges, having handles behind for regulating it by, and hooks with chains and swingle-trees before for attaching the team to. It takes a breadth of about four feet at a time. A man, a horse, and a boy, will, it is said, in a dry time, do fifty rods a day with it. A representation of it may be seen in the second volume of the Essex Corrected Report on Agriculture.

Surface-DRAINING Mole-Plough, a sort of plough made use of for the draining of grass-lands, where it is a material object not to have the surface injured; yet to have the moisture removed at particular wet seasons, as in parks and pleasure-grounds, &c. It is a sort of draining-plough that has been said to answer well with six or eight horses. The first plough of this kind was probably invented by Mr. Adam Scott; but a great variety of implements of this sort have since been contrived, though none probably that perfectly answers the purpose in every intention. They have, however, been so far improved, as to be wrought with much less power or strength of team, and sometimes by means of human labour, without the treading of teams at all. The mole or breast parts of them have been so altered, as to slide through the soil with much greater facility than was the case at first, as has been seen in speaking of the improved tool of this fort under its proper head. See Mole-Plough.

It is a plough too which has been used on the arable peaty lands, in some parts of Lancashire, with great success.

Surface-DRAINING Pump, that sort of pump of this kind which is contrived for the purpose of raising and discharging the water which fluctuates in large quantities on lands in some situations, where there is none or very little drainage level. These pumps are mostly of a very simple nature, and contrived so as to lift the water over the banks by which it may be surrounded. The writer of the late work on "Landed Property" is of opinion, that by means of powerful pumps of this sort, many of the cold flat lands which lie at the feet of hills, in almost every vale district of the kingdom, might be drained and considerably improved in different ways. See Surface-DRAIN and Surface-Draining.

SURFEIT, an indigustion caused by excess in eating or drinking, that is, by over-charging the stomach; and usually attended with eruptions, and sometimes with a fever.

SURFEIT, among Animals, a particular sort of complaint which is incident to horses and other cattle belonging to farms, and which arises from various causes; but is commonly the effect of some affection not attended to, or ill cured, and frequently from the want of food and management. It also proceeds from excessive and immediate feeding, but especially upon unwholesome food; from cold and hard riding, &c. whereby the animals for take the meat, and are infected with hard swellings, which, if they happen to fall upon the joints, will, in process of time, occasion lameness, and many other disorders. Animals are said to be surfeited, when their coats become thin, and look ruddy and dirty, though proper means have not been wanting to keep them clean. The skin is full of scales and lumps, that lie thick and mealy among the hair, and are constantly supplied with a fresh succession of the same, for want of due inspiration. Some have hurdles of various sizes, like pessaries; others have dry fixed fitches of their limbs and bodies; still others a moisture attended with heat and inflammation; the humours being so sharp, and violently acting that the animals rub it incessantly, as to make themelves miserable, and some have no eruption at all, but an unwholesome look, and are dull, sluggish, and lazy. Some appear only lean and hide-bound, others have flying pains and lancets resembling a rheumaticin; so that, in the surfeits of animals, we have almost all the different appearances of scurvy and other chronic distempers.

In all surfeits of animals, care should be taken to have them well managed, both with respect to their food and other matters, frequent changes being highly necessary and useful.

SURFEIT-Water, is a water distilled from poppies, and other herbs, proper to cure indigestions.

SURFUNDKAR, in Geography, a town of Aşık Turkey, in Aladula; 25 miles S. of Marashe.

SURGAB, a town of Candahar, on the Kame; 41 miles S.E. of Cabul.

SURGERIES, a town of France, in the department of the Lower Charente, and principal place of a canton, in the district of Rochefort; 12 miles N.E. of Rochefort. The place contains 14,771, and the canton 11, 203 inhabitants, in a territory of 2614 square kilometres, in 18 communes.

SURGE. The sailors call a wave, or bellow of the sea, a surge.

After, when they are hearing at the capstan, if the cable happen to slip back a little, they say, the cable surge.

SURGE, in Ship-Building, the tapered part in front of the whelps, between the chocks of a capstan, upon which the
when judiciously hollowed, the messenger, &c. may surge itself without any other incumbrance.

To Surge, is to let a cable, or rope, round a capitan slide up it, by gently flacking the part held on.

SURGEONS, Company of. See Company. See also PHYSICIANS.

SURGERY, or Chirurgery, (derived from chirurgeon, from 264, the hand, and 4790, one.) has generally understood to be that branch of medicine which principally affects the cure of diseases by the application of the hand alone, the employment of instruments, or the use of topical remedies. (Encyclopédie Méthodique, Partie Chir. tom. i. art. Chirurgie.) But although this definition certainly conveys to one some idea of the nature of this most useful profession, it is not entirely accurate as applied to the present rate of practice. In ancient days, the surgeon was a mere assistant to the physician; the latter alone not only having the sole privilege of prescribing internal medicines, but even that of judging as to the performanc when surgical operations should be performed. The subordinate surgeon was only called in to execute with his knife, or his hand, duties which the more exalted physician did not choose to undertake; and, in fact, he visited the patient, did what was required to be done, and then took leave of the case altogether under the orders of his master. In modern times, however, the good fends of mankind has discovered, that surgery is deserving of an eminent rank among such arts as ought to be cultivated for the general benefit of society; that the man who is not himself accustomed to the performance of operations, cannot be the best judge of their safety and necessity; and that, in every point of view, the surgical practitioner merits as much favour and independence in the exercise of his profession, as he whose avocation is confined to hygiene. Hence the surgeon is now exclusively confided about many of the most important diseases to which the human body is liable. Being no longer under the yoke of the physician, he follows the dictates of his own judgment and knowledge; he prescribes whatever medicines the caxe may demand, internal as well as external; and under the encouragement of an enlightened age, he sees his profession daily becoming more scientific, more respected, and more extensively useful.

It is an observation made by the celebrated Bichat, that two things are essentially necessary to form a great surgeon, genius and experience. One traces for him the way, the other refines it; both reciprocally assist in forming him. Without experience, genius would be unprofitably fertile; without genius, experience would only be a barren advantage to him. (Œuvres Chr. de Defaut, par Bichat, tom. i. Décours Prél. Out of the large number of hospital surgeons who are to be met with in every country of Europe, and who enjoy ample opportunities of profiting by the lessons of experience, how few distinguish themselves, or even contribute a mite to the improvement of their profession. Opportunity, without talents and an aptness to take advantage of it, is not of more use than light to a blind man. On the other hand, splendid abilities, without experience, can never be enough to make a connoisseur surgeon, any more than a man with the greatest genius for painting can excel in his particular art without having examined and tasted the real objets which he wishes to delineate. In short, as a sensible writer has remarked, "les grands chirurgiens sont assi rares, que le génie, le favoir, et les talens." Mem. de l’Acad. de Chir. tom. i. pref. p. 41. edit. 18mo.

The description of the qualities which a surgeon ought to possess, as given by Celius, is excellent as far as it goes. A surgeon (says he) should be young, or, at any rate, not very old; his hand should be firm and steady, and never shake; he should be able to use his left hand with as much dexterity as his right; his sight should be acute and clear; his mind intrepid and pitted, so that when he is engaged in doing anything to a patient, he may not hurry nor outlasts he ought, but finish the operation just as if the safety of the patient made no impression on him. A. C. Celsi Med. Inst. ad lib. vii.

By the word "immiifferos," as Richerand has observed, (Noël Chr. tom. i. p. 42, edit. 2.) Celius did not mean that a surgeon ought to be quite intemperate to pity; but that during the performance of an operation, this passion should not influence him, as all emotion would then be more weakens. This undisturbed coolness, which is still more rare than skill, is the most valuable quality in the practice of surgery. Dexterity may be acquired by exercise; but firmness of mind is a gift of nature. Hailer, to whom nature was so bountiful in other respects, was denied this quality, as he candidly confesses. Although (says he) I have taught surgery seventeen years, and exhibited the most difficult operations upon the dead body, I have never ventured to apply a cutting instrument to a living subject, through a fear of giving too much pain." Bibl. Chr. 1775, tom. ii.

Surgery may boast of having an origin that well deserves to be called noble; for the earliest practice of it arose from the most generous sentiment which nature has implanted in the heart of man, vis. from that sympathetic benevolence which leads us to pity the misfortunes which we behold, and inspire us with an anxious desire to alleviate them. He who first saw his fellow-creature suffer, could not fail to participate in the pain, and endeavour to find out the means of affording relief. Opportunities of exercising this useful inclination were never wanting. In the first ages of the world, man in his deffinite status was under the necessity of earning, by force or frigatam, a subsistence which was always uncertain, and in the combats which this sort of life drew him into, he frequently met with wounds and other injuries. The consequence was, that he began at a very early period to pay attention to the mode of curing accidental hurts. Wars, by multiplying wounds, at the same time increased the necessity for assistance, and enhanced its value. Kings themselves then did not disdain to dres wounds, and several of the warriors sung by Homer, derived not less renown from their skill in surgery, than from their valour in war. Such were Chiron, Machan, and Podalirius. It is in the immortal poems of the Iliad and Odyssey, that we find the only certain traditions respecting the state of the art before the establishment of the republics of Greece, and even until the epoch of the Peloponnesian war. There it appears, that surgery was almost entirely confined to the treatment of wounds, and that the imaginary power of enchantment was joined with the use of topical applications.

In the cures recorded in the sacred writings of the Christian religion, the intervention of a supernatural power is always combined with what is within the scope of human capability. The same character evinces itself in the infancy of the art in every nation. The priests of India, the physicians of China and Japan, and the jugglers of the savage and half civilized tribes of the old and new continents, contumely affiliate with drugs and manual operations certain miraculous practices, upon which they especially rely for the cure of their patients. Such was also, no doubt, the character of the medicine of the Egyptians in the remote times, previously to the invention of the alphabet, and upon which so very little light is now thrown.

We next come to the epoch when, by the union and arrangement of scattered facts, the science truly arose. Hip-
Surgery.

pocrates, born in the island of Cos, four hundred and sixty
years before the common era, collected the observations of
his predecessors, added the results of his own experience,
and composed his first treatises. In the hands of this great
genius, medicine and surgery did not make equal progress.
The former reached the highest degree of glory. Hippo-
crates drew up the history of acute diseases in so masterly a
style, that twenty past centuries have hardly found occasion
to add anything to the performance. But surgery was far
from attaining the same degree of perfection. The religious
veneration for the aulums of the dead, and the impossibility of
disturbing the human body, formed an insurmountable
obstacle to the study of anatomy. An imperfect acquaint-
ance with the structure of animals, reputed to bear the
greatest resemblance to man, could only furnish venturous
conjectures, or false inferences. Their circumscribed no-
tions sufficed for the study of acute diseases. In these cases,
the attentive observation of strongly marked symptoms, and
the idea of the operation of a salutary principle, derived
from remarking the regular succession of such symptoms,
and their frequently beneficial termination, enlightened the
physician in the employment of curative means; while sur-
gery, deprived of the assistance of anatomy, was too long
kept back in an infant state. Whatever praefaces may have
been bestowed on those parts of the works of Hippocrates
particularly relating to surgery, and which amount to fix in
number (de officina medicis, de fracturis, de capitis vulneris,
de articulis vel luxatis, de ulcerebus, de fistulis), when
compared with his other acknowledged legitimate writings,
they appear only as the rough sketches of a picture by a
great master.

Excepting the fragments collected or cited by Galen, we
possess no work written by any of the successors of Hippo-
crates until the period of Celsus, which leaves a barren in-
terval of almost four centuries. In this space lived Eras-
tratus, as well as Herophilus, celebrated for the feats which
they established, and particularly for having been the first
who studied anatomy upon the human body.

Celsus lived at Rome in the reigns of Augustus, Tiberius,
and Caligula. He appears never to have practised the heal-
ing art, on which however he has written with much preci-
cion, elegance, and perspicuity. His work is the more
precious, inasmuch as it is the only one which gives us in-
formation with regard to the progress of surgery in the long
interval between Hippocrates and himself. The four last
books, and especially the seventh and eighth, are exclusively
allotted to surgical matter. The style of Celsus is so ele-
gant, that he has generally been regarded quite as the Cicero
e of medical writers, and long enjoyed high reputation in the
schools. His surgery was entirely that of the Greeks, not
withstanding he wrote at Rome; for, in this capital of the
world, phylaxis was then professed only by peripatetics who
had either come from Greece, or had received instruction in
the celebrated schools of this native soil of all the arts and
sciences.

Let us pass over the interval which separates Celsus and
Galen. This latter was born at Pergamus, in A sia Minor,
and came to Rome in the reign of the emperor Marcus Au-
relius. He practised surgery and physic there about the
year 165 of the Christian era. (Galeni Opera Omnia, 1521,
ed. Aldi, 5 vols. in fol.) These two sciences were at
that time still united; and though some writers of much
earlier date speak of the division of physis into dietetical,
chirurgical, and pharmaceutical, no such distinction was
followed in practice. As Galen had been a surgeon at Per-
gamus, he continued the same profession at Rome; but
being soon attracted by the predominating taste of the age
in which he lived, for a science which more easily yields to
the futes and dazzling speculations of philosophical foils,
he afterwards neglected surgery, which firmly rejected him.
His writings prove, however, that he did not abandon it en-
tirely. His commentaries on the treatise of Hippocrates,
"De Officina Medicis," and his essays on bandages, and the
manner of applying them, showed that he was well versed in
the minor details of the art. Besides, it is known that he
paid great attention to pharmacy; and in his work upon
antidotes, chapter 13, he tells us himself, that he had a drug-
shop in the Via Sacra, that fell a sacrifice to the flames,
which destroyed in the reign of Commodus the temple of
Peace and several other edifices.

After Galen come the compiler Oribasius, Elisis of
Amida, a physician who lived towards the close of the 5th
century, Alexander of Tralles, and Paulus Agnus, who
called from the place of his birth. This last collected into
one work, still justly esteemed, all the improvements which
had been made in surgery up to his own time. Paulus
concludes the series of Greek and Roman physicians, and
he may be looked upon as the last of the ancients, unless it is
wished to let the Arabians have a share in the honours of
antiquity. Paulus practised at Rome and Alexandria. Af-
fterwards the ruin of surgery followed that of all the sciences,
and from the capture of Alexandria by the Saracens under
Anrago, history of Egypt, in 641, until the end of the
ten century, nothing prevailed but the dark clouds of
ignorance and barbarism.

Matters of a great part of the Roman empire, the Arabi-
ans dug up the Greek manuscripts, which were buried
under the ruins of the libraries, translated them, appropriated
themselves to the doctrines which they contained, made them
poorer with additions, and transmitted to posterity only
enormous compilations. In a word, such are the treatises
of Rhazes, Hali Abbas, Avicenna, Averroes, and Almo-
ella, the most celebrated of the Arabic authors. Inven-
tors of a prodigious number of instruments and ma-
Chines, they appear to have calculated the efficacy of sur-
gery by the richness of its arsenal, and to have been more
anxious to inflame terror than confidence. As an instance
of the cruelty of their methods, we shall merely notice, that
in order to stop the bleeding after amputation of a limb,
they were in the habit of plunging the end of the stump into
boiling pitch.

The state of medicine was not more fortunate. In the
school of Salernum, founded about the middle of the
seventh century, some attempts to revive its fabour.
Medical science being fasted on the same beach,
where the doctrine of Aristotile, accommodated to religious
opinions, was the subject of endless controversies, the im-
bibed, as it were by contagion, the argumentative and
philosophical mania, and became enveloped in the dark hypo-
theses of scholastic absurdity. Richerand, Nonographie Chur-
scule, tom. i.

The universal ignorance (continues this author) is the
horror of blood; the dogma of a religion, which fixed it
as a torment to useless quarrels; an exclusive rehild to the sub-
eteties of the school, and speculative theories; are circum-
cstances which further explain the profound darkness which
followed such empty labours. About the middle of the
twelfth century (1163), the council of Tours prohibited the
ecclesiastics, who then shared with the Jews the practice
of medicine in Christian Europe, undertaking any bloody
operation. It is to this epoch that the true separation of
medicine from surgery must be referred. The latter was
abandoned to the laity, who in those ages of barbarism were
almost all entirely unlettered and delitute of education.
Surgery.

The priets, however, still retained that portion of the art which abdained from the effusion of blood. Roger, Rolandus, Bruno, Gulielmus de Salicetus, Lanfranc, Gordon, and Guy de Chauliac, confined themselves to commentaries on the Arabians, and mutilated surgery, by reducing it almost entirely to the use of ointments and plasters. Guy de Chauliac, however, the last of the Arabians, must be excepted from this censure. His work, written at Avignon, in 1363, on the artifices of Urban VI., whose physician he was, continued to be for a long while the only classical book in our schools. It may be observed, that as he imitated in every respect the other Arabian physicians, and like them thought that it did not become an ecclesiastic to devote from the superlevity of his profession, he has passed over in silence the disfaves of women.

Antonius Benvenius, a physician of Florence, was the first who perceived that the compilations of the ancients and Arabians ought to be relinquished for the observation of nature. (De Abditis Rerum Caesar, Florent. 1507, 4to.)

A new era was now begun. The moderns, faw, that, by treading servilely in the footsteps of their predeceffors, they should never succeed in equaling them. The work of Velatus gave birth to anatomy. Illuminated by this science, surgery, having been prepared by the works of some Italian physicians, put on a different appearance in the hands of Ambroise Paré, the first and most eminent of the French surgeons.

Obeying the dictates of his genius, Paré made authority yield to observation, or fought to reconcile them, when envy, bullly intent on persecuting him, represented his discoveries as a crime. Although he was the refoter, if not the inventor, of the art of tying the blood-veigs, he was compelled to make imperfect extracts from Galen, and alter the text, in order to rob himself, in favour of the ancients, of the glory which this disfigured improvement deferred.

Surgeon of king Henry II., Francis II., Charles IX., and Henry III. of France, he practiced his profession in various places, followed the French armies into Italy, and acquired much esteem, that his mere presence in a besieged town was enough to reanimise those employed for its defence. In the execrable night of St. Bartholomew, his reputation saved his life. As he was of the reformed religion, he would not have escaped the massacre, had not Charles IX. himself undertaken to protect him. The historians of those days (Mem. de Sully) have preferred the remembrance of this exception, so honourable to him who was the object of it; but which should not diminish the just horror which the memory of the most weak and cruel tyrant must ever inspire.

"Il n'en voulut jamais fauver aucun (fays Brantome) ficon maître Ambroise Paré, fon premier chirurgen, et le premier de la chretienitée; et l'envoya quitter et venir le foir dans fa chambr e et garderobe, lui commandant de n'en bouger; et disait qu'il n'était raisonnable qu'un qui pouvait servir à tout un petit monde; feut ainsi malçrée."

Ambroise Paré was not content, like his predecessors, with exercising his art with reputation; he did not follow the example of the Quatre-maîtres of Pitard, so jubily celebrated for having composed the first statutes of the College of Surgeons at Paris, in the reign of St. Lewis, whom he had attended in his excursions to the Holy Land; and of several other surgeons, the fruits of whose experience were lost to their successors. Paré transmitted the result of his own experience in a work that will remain immortal. See Œuvres d'Ambroise Paré, Confeiller et premier Chirurgen du Roi, diviées en 28 livres, in folio, edit. 4. Paris 1585.

His writings, fo remarkable for the variety and number of facts in them, are eminently disfigured from all theo of his time, insamuch as the ancients are not looked up to in them with superfluous blindness. Freed from the yoke of authority, he submitted every thing to the test of observation, and acknowledged experience alone as his guide. The French writers are with reason proud of their countryman Paré to this day: they allege, that he must ever hold amongst surges the place that Hippocrates occupies amongst physicians. Nay, they add, that perhaps there is no one either of the ancients or moderns, who are worthy of being compared with him. Richerand Nofographie Chirurg. tom. i.

After the death of this great man, surgery, which owed its advancement to him, continued stationary, and even took a retrograde course. This circumstance is altogether ascribable to the contemptible state into which those who professed the art fell, after being united to the barber by a moit disgraceful allocciation.

Pigrai, the successor of Ambroise Paré, was far from being an adequate substitute for him. A spiritless copier of his master, he abridged his Surgery in a Latin work, where the unaffected graces of the original, the sincerity, and the ineffable charm, inseparable from all productions of genius, entirely disappeared. He received, however, equal praise from his contemporaries; doubtful, because he filled a high station. But, as Richerand remarks, his name, which is to-day almost forgotten, proves sufficiently that dignities do not constitute glory.

Roulet and Guillemeau disfigured themselves in the art of midwifery; while Covilliard, Cabrol, and Habicote, enriched surgery with a great number of curious observations. See Obs. Chir. pleines de Remarques curieuses, Lyon, 1639, 8vo.; Alphabet Anatomique, Genève, 1622, 4to.; and Semaine Anatomique Quelton Chir. fur la Bronchotomy, Paris, 1620, 8vo.

In the next or 17th century, the fame impulse produced additional improvements. Then appeared in Italy Cesar Magatus, who simplified the treatment of wounds. (De Rara Vulnerum Medicationis, ib. iv. 1615, fol.) Fabricius ab Aquapendente, even left praiseworthy as a surgeon than as a physiologist (Opera Chir. Paris, 1613, fol.); and Marcus Aurelius Severinus, that reforer of active surgery (De Efficaci Medicinæ, ib. iii. Francfort, 1613, folio; De Recondita Abcefiium Natura, ib. viii. Neapoli, 1632, 4to.; and Trinembris Chirurgia, &c. Francfort, 1653, 4to.) Amongst the English surgeons flourished Wileman, who was the Paré of England (see Several Chirurgical Treatises, London, 1676, fol.); and William Harvey, whose discovery of the circulation of the blood had such an influence over the advancement of surgery, that he must be classed among the principal improvers of this science. (See Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus, Francoforti, 1655, 4to.) In Germany, Fabriicus Hildanus (Obs. et Curationum Centuria, 2 vols. 4to. 1641.) This Fabricius was far superior to the other. Scultetus, so well known for his work, entitled, "Armamentarium Chirurgicum, Ulmæ, 1653, fol." Pürmann and Solingen, who had the fault of being too partial to the use of numerous complicated instruments. See Curie Obs. Chir. Lipphiæ, 1710, 4to. Mannala Obs. der Chirurgie, Amsterdam, 1684, 4to.

Holland, restored to liberty by the generous exertions of its inhabitants, did not remain a stranger to the improvement of surgery. This nation, so singular in many respects, presents us with one particularity, which claims the notice of a medical historian. Ruyfch, who was an eminent anatomist, and merits equal celebrity for his Obs. Anatomico-Chirurg-
Surgery.

Chirurgicum Centuriae, Amsterdam, 1691, in 4to. carried with him to the grave the secret of his admirable injections. (See also his Théaur. Anat. X. 4to. Adversari-orum Anatomicorum Medicos-Chirurgorum, Decad. 3. 4to. Amsterdam.) Rohouyer, he also made a secret of his lever, which, before the invention of the forceps, was the only resource in difficult labours. Raw, who successfully cut 1500 patients for the stone, took such pains to conceal his manner of operating, that Heister and Albinus, his two most distinguished pupils, have each given a different explanation of it. Such a disposition, which was extremely hurtful to the advancement of surgical knowledge, would materially have retarded the progress of surgery in Holland, had not Camper in the following century effaced this imputation by the great number of his discoveries, and his zealous desire to make them public.

In the midst of these improvements, of which Ambroise Paré may be considered as the promoter, surgery in France languished in a most humiliated state. The accoucheur Mauriceau (Tracté des Maladies des Femmes Grosses, Paris, 1668, 4to.), Dionis (Cours d’Opérations de Chirurgie, Paris, 1707, 8vo.), Saviard (Novveau Recueil d’Obst. Chir. Paris, 1702, 12mo.), and Belboeuf (Chirur-gien d’Hospital, Paris, 1669, 8vo.) were the only French surgeons of note, and most of them conversed with 10 or 15 distinguished men of other nations. Richerand observes, that the splendid days of Lewis XIV. were an iron age for discouraged surgery. This monarch did, indeed, escape from falling a victim to a surgical disease, a fistula in ano; but he was not cured till after a great number of blundering operations and useless experiments.

According to Richerand, the reign of Lewis XIV. presents us with much pomp and ostentation, the common attributes of the early state of societies. Poetry, eloquence, painting, and all the arts of pleasure and imagination, then shone with the most vivid light. On the contrary, the 18th century exhibits the character of maturity; calculators, naturalists, and philosophers, have taken the place of orators and poets; the useful arts and sciences have triumphed over the objects of pleasure; the empire of reason has succeeded that of imagination; and far more has been done, if not for the glory, at least for the happiness, of the human race. Let us hope, says Richerand, that the commencing century may not lead us back to infancy, through decrepitude. A more stern condition is imposed with it, that in all our actions, exposed to the views of others, we are more practised in opinion, and practice, condemned by experience, would be too certain a proof of it.

Chronology teaches only the history of dates. In the study of the sciences, the only method of impressing the memory with facts, consists in connecting the epochs of them with the learned men who have illustrated them. But the greatest surgeons of the 18th century have not altered the face of their profession, although they have powerfully contributed to its advancement. In surgery, as an author has remarked, some feathers always precede brilliant lights, and it approaches perfection in a very gradual way. In the 18th century, however, amongst the distinguished surgeons of France, there are two of extraordinary genius, round whom, as it were, all the others might be grouped and arranged, and whose names deserve to be affixed to the two most splendid epochs of French surgery. These are, first, L. Petit, whole glory has been shared by the Academy of Surgery; and, secondly, the celebrated Dufour.

It is not with surgery, as with physic, strictly so called; the epochs of the latter are distinguished by hypotheses; while those of surgery are marked by discoveries. The eminent men in this last branch of the profession have not, like the most renowned physicians, created facts, built systems, destroyed those of their predecessors, and contributed to a new edifice, which in its turn has been demolished by other hands. All of them have been satisfied with combating ancient errors, discovering new facts, and continuing their art, the sphere of which they enlarged by their discoveries, without making it bend under the yoke of systems, which it would have ill supported. To this steady and uniform course, says Richerand, which is a striking proof of the superiority of surgery, and of the certainty and invariable principles of its principles, all we oppose the numerous revolutions of physic? The Christian religion, which abounds in facts, has not more than physic. "Naturals, solidites, humornites, virtutis, comites, magnos, diversos, manerios, mendios, arescites, innumeris; le plus grand nombre des medecins honore Hippocrate d’un culte presque superstitieux: ceci marchent sous les bannières de Stahl; ceux-là s’appuient du grand nom de Bœhrave; tels autres inquovet, Sydenham, Hoffmann, Stoll, abolument comme les théologes combattent pour Luther, Zuingle, Calvin, ou Jasæ."

Nofogr. Chir. tom. i.

The elegy on J. L. Petit, delivered in the midst of the Royal Academy of Surgery, of which he was one of the first and most distinguished members, represents him as a blending of the study of anatomy with his amusements when a boy; and ardent seeking every opportunity to increase his knowledge by observation. He had had experience enough to publish, at an early period of his life, his "Traité sur les Maladies des Os," Paris, 1705, 12mo.; a work, which for a century was esteemed the best upon the subject. It may be noticed, that his success was most virulently opposed by the envious critics. It was not till after more than thirty years of academical labours and extensive practice, that he was unanimously elected as the chief of his colleagues. This acknowledged superiority was the more flattering, as J. L. Petit obtained it at a period when surgery was in a flourishing state in France, and where he held no place from which he could derive an influence foreign to his personal merit. While Marechal, La Peyronie, and La Martiniere, afforded him of the royal favour, Quefayry, Morand, and Louis, who corrected his writings, made him speak a language that does honour to the famous collection to which he contributed his observations (see Memoires et Prix de l’Académie Royale de Chirurgie, 10 vols. 4to.), and in which, if we except some theoretical explanations, nothing has lost its value by age. In short, it will ever be considered as one of the most valuable collections of surgical knowledge.

J. L. Petit was also the author of a "Traité des Maladies Chirurgicales, et des Operations qui leur conviennent: Ouvrage poïthume;" a production that will always hold high in the estimation of the judicious surgeon.

The history of this epoch, so glorious for the profession of surgery, is completely detailed in the "Memoires et Prix of the Royal Academy of Surgery," a work which is absolutely indispensable, and the various parts of which cannot be too often considered. In it are preferred the labours of Le Dran, Garengereot, De La Faye, Louis, Vedier, Fouquet, Bevin, Pibrac, Fabre, Le Cat, Borda, Sabatier, Pozos, Levret, and several other practitioners, who, though less famous, have contributed by their exertions and knowledge to form this useful body of surgical facts. The preceding surgeons also distinguished themselves by other productions. Le Dran published 1. Parallèle des différentes Manières de tirer la Pierre hors de la Vesic, 1 vol. 12mo.

2. Opération
Surgery.

2. Opérations de Chirurgie, 2 vols. 12mo.
4. Traité des Plaies d'Armés à feu, 1 vol. 12mo.
5. Confutations de Chirurgie, 1 vol. 12mo.

Garegeot wrote:
1. Traité des Instrumens de Chirurgie, 2 vols. 12mo.
2. Traité des Opérations de Chirurgie, 3 vols. 12mo.

Fabre was the author of:
Recherches sur l'Art de Guérir, 1 vol. 8vo.

Le Cat wrote:
Recueil des Pièces sur l'Opération de la Taille.

Sabatier published the:
Médecine Opératoire, 3 vols. 8vo.

Puzos composéd:
Traité des Aaccouchemens, Paris, 1759, 4to.

Levet wrote:
2. Art des Aaccouchemens, démontré par les Principes de Physique, Paris, 1761, 8vo.

The foregoing list of eminent French surgeons must be added the names of La Motte, Maître-Jean, Goulard, David, Ravaton, Mejean, Pouteau, David, and Frère Cofone.

La Motte published:
2. Traité complet de Chirurgie.
Maître-Jean was the author of:
Traité des Maladies de l'Oeil, 1 vol. 4to.

Goulard wrote:
Oeuvres de Chirurgie, Liege, 1763, 2 vols. 12mo.

Ravaton composéd:
Le Chirurgien d'Armée.

Pouteau:
1. Melanges de Chirurgie, 1 vol. 8vo.
2. Œuvres posthumes, 3 vol. 8vo.

David:
Observations sur la Nécrose, Paris, 1782, 8vo.

While surgery was thus advancing in France, other nations were not neglectful of it. At this period flourished in England, Cheffelden, Douglas, the two Monros, Sharp, Cowper, Alphonan, Percival Pott, Hawkins, Smellie, and the two Hunters.

Cheffelden's Treatise on the High Operation of the Stone, London, 1723, 8vo. and his Treatise on the Anatomy of the Human Body; Douglas's tract, entitled, "Lithotomy Douglaissiana;" Sharp's Treatise of the Operations, and his Critical Enquiry into the Present State of Surgery; Monro's Works, by his Son; Alphonan's Treatise on Amputation; Pott's Chirurgical Works; Smellie's Midwifery; and John Hunter on the Blood, Inflammation, &c.; his Treatise on the Venereal Disease; Animal Economy; and all the papers written by himself and his brother are productions, which reflect the highest credit on the state of Surgery in England.

At the period when the preceding distinguished men upheld the character of their profession in Great Britain, Molinelli, Bertrand, and Mofcati, were doing the same thing in Italy. Bertrand's Treatise on the Operations of Surgery is even at this day a work of the highest repute. In Holland flourished Albinus, Deventer, and Camper; and in Germany and the north of Europe, Heister, well known for his Institutiones Chirurgiae, Platter, Roederer (Elementa Artis Obstetriciae, Goett. 1752; Obi. de Partu Laborioso, Decad. ii. 1756; Stein; Bilguer; Acrel; Calliére (Principia Systemates Chirurgiae Hodiehens, 2 vols. 8vo.) Brambilla; Thedem (Progrès ultérieurs de la Chirurgie); and Richter, Traités des Heresies, 2 vols. 8vo.; Bibliotheca de Chirurgie; Anfanggr. der Wundarzneykunst, 7 vols.; and Obi. Chirurgicarum Fali.

On the continent, the Academy of Surgery at Paris was long considered quite as the polar light of this branch of science. The French revolution, which, by a fatal abuë, involved in the same prohibition useful as well as improper societies, did not spare even this beneficial establishment. Although the academy was deprived of the talents of M. Louis, who died a short time before its suppression, it yet lived at this period, several members worthy of continuing its labours and supporting its reputation. Sabatier, Default, Chopart, Lafu, Peyrilhe, Dubois, Percy, Baudeloque, Pelletan, Sue, &c. were still remaining.

Default wrote:
1. Journal de Chirurgie, 4 vols. 8vo.
2. Œuvres Chirurgicales, recueillies par Bichat, 3 vols. 8vo.

Chopart:
Traité des Maladies des Voles urinaires, 2 vols. 8vo.

Percy:
Pirotechnie Chirurgicale, &c.

Baudeloque:
Traité des Aaccouchemens, 2 vols. in 8vo.

The Academy of Surgery in France was succeeded by what is named the Ecole de Médecine. Default, who had been almost a stranger in the former, became quite the leading character in the latter. Several things recommended him strongly to the remembrance and admiration of posterity: the exactness and method which he introduced into the study of anatomy; the ingenious apparatus which he invented for the treatment of fractures (see Surgical Plates); a noble ardour in his profession, which he knew how to impart to all his pupils; his clinical lectures upon surgery, which were the first ever delivered; and the boldness and simplicity of his modes of operating. Indeed, such was his genius, that even when he practised only methods already understood, he did them with so much adroitness, that he rather appeared to be the inventor of them. From the Ecole de Médecine have issued Boyer, Dubois, l'Héritier, Manouvy, Lallement, Petit de Lyon, Bichat, &c.

The researches of Bichat, who quitted surgery, powerfully contributed to the advancement of physiological science. His mind, richly stored with the positive facts which he had learned in the study of surgery, conceived no less a project, than that of rebuilding the whole edifice of medicine. Some courses of lectures upon the materia medica, internal clinical medicine, and morbid anatomy, announced this vast design, which was frustrated by a premature death. Bichat died in the midst of his labours, and, in dying, his greatest regret was that of not having completed them. His example, says Richerand, proves most convincingly what Boerhaave always inculcated, how indefensible the study and even the practice of surgery are to him, who would wish to be a disinterested and usefulness physician. Nologr. Chir. tom. i. p. 25.

Perhaps nothing contributed so materially to the improvement of surgical knowledge, as the establishment of the Royal Academy of Surgery in France; a noble institution, which, for a long while, gave our neighbours an infinite advantage over us, in the cultivation of this most useful profession. Indeed, every one truly interested in the improve-
improvement of surgery, cannot fail to regret the discon-
tinuance of a society, in which emulation and talents were
so long united for the benefit of mankind. The various
difficulties, published by the illustrious members of the
Academy, will serve as a perpetual memorial of the spirit,
ability, and success, with which the objects of the institu-
tion were pursued; and centuries hence, practitioners shall
reap from the pages of its memoirs the most valuable kind
of surgical information. Unfortunately, this establishment,
which was overturned by the agitation of the French re-
volution, has had only a very inferior sublimation in the
École de Santé.

Were we to name any one thing, which, in our opinion,
would have the greatest influence in giving life to the study
and cultivation of surgery in this country, we should, with-
out hesitation, assign such importance to the establishment
of an institution in the metropolis, on the same ground, liberal,
and encouraged plan, as the late Royal Academy of Sur-
gery in France. At least, why should not the theatre of the
College of Surgeons be open to all its members once a
week, and a meeting be held, under the control of a worthy
president, for the purpose of reading and discussing original
surgical essays and observations? The present Medico-
Chirurgical Society of London, truly deserve the utmost
encouragement the profession can bestow; but in a sur-
gical point of view, it might be better, were surgery alone
the particular object of their consideration. No sooner did
the Academy of Surgery change into the École de Médecine,
than a manifést falling off occurred. It is right that phy-
cicians should understand surgery, and surgeons physic;
but it does not follow, that it is therefore advantageous to
have these two subjects continually blended together.
According to our ideas, a society, exclusively formed for the
discussion of surgery, will, ceteris paribus, prove much more
useful and successful, than another which embraces every subject
whatsoever connected with medical science.

Within the last twenty or thirty years, most important
improvements have certainly been made in almost every
branch of surgery; and it must gratify every Englishman
to find, that his own countrymen have acted a very leading
part in effecting an object, in which the interests of mankind
are so deeply concerned.

Before the time of Mr. John Hunter, our ideas of the
venereal disease were surrounded with absurdities; and it is
to this luminary, that we are in an eminent degree indebted
for the increased discrimination and reason, which now prev-
vail both in the doctrines and treatment of the complaint.

Strictures in the urethra, an equally common and dis-
tressing disease, were not well treated of before Mr. Hunter
published on the venereal disease; and the advantage of
armed bougies in the treatment of certain cases, has been
subsequently pointed out by sir Everard Home.

Ruptures, those common affections in every country,
have received in modern times highly interesting elucidations
from the labours of Pott, Camper, Richter, A. Cooper,
Hey, Gimbernat, Scarpia, Lawrence, &c.

The treatment of injuries of the head has been materially
improved by Quefnay, Le Dran, Pott, Hill, Aber-

nethy, &c.

The disease of the vertebra, which occasions paralysis
of the limbs, formerly always baffled the practitioner; but
the method proposed by Mr. Pott, is now frequently pro-
ductive of considerable relief, and sometimes of a perfect
cure.

The mode of treating lumbar abscesses has been rendered
much more successful than formerly, and for this change,
the world is indebted to Mr. Abernethy.

The almost infallible plan of curing hydroceles by an in-
jection, as described by Sir James Earle, may also be em-
owered amongst the recent improvements.

The increasing aversion to the employment of the gortex
in lithotomy, and the many distinguished advocates for the
ute of better instruments in this operation, may be hailed
as propitious omens of beneficial changes in this part of
practice.

In the treatment of united fractures, the simple un-
ingenuous practice proposed by Dr. Phyfie of Philadelphia,
merits particular notice; not only on account of the se-
veral successful trials which have been made of it in his
country and France (see Medico-Chir. Trans. vols. i.
and viii. and Boyer's Traité des Maladies Chir.,) but also
because it is perhaps the first improvement that has hitherto
been made in the practice of surgery by our transatlantic
brethren.

The indefatigable treatise of Dr. Jones on hæmorrhage,
has now produced quite a revolution in all the principles
by which the surgeon is guided in the employment of the lig-
ure for the formation of fluctuations, the removal of scrotal.
Instead of thick clumsy cords, small firm filks, or threads, we
now generally used; and so far is the practitioners from being
scared of tying arteries too tightly, left the ligature on
through them, that it is now a particular object with him to
apply the silk, or thread, with a certain degree of force, a
order that the inner coat of the vesse1 may be divided. If it
be not done, the effusion of coagulating lymph within the
artery, an important part of the process of obliteration,
cannot be expected as a matter of certainty, and secondary
hæmorrhage is more likely to occur. But in order to con-
vay an adequate idea of the beneficial changes which Dr.
Jones's observations are tending to produce in practice,
we have been careful in the article Hæmorrhage, to give a
tolerably full account of the results of all his interesting
experiments.

Besides using very small, firm, round threads, instead of
large, flat tapes, or cords, as was the custom a few years
ago, modern surgeons begin to use filks, that much better
may also arise from cutting off both portions of the ligur-
there to the knot, as to the removal of the breast, &c.
No one has infused so much as Mr. Lawrence
upon the propriety of examining further the merits of this
innovation. If no bad effects result from leaving so small
a filk by the knot, and noose on the artery, the
practice will form a considerable improvement. The
wound may then be brought together at every point; the quantity
of extraneous matter in the wound will be lessened to about
nothing; the danger of convulsive affection will be least
in proportion as a serious cause of pain and irritation is
diminished; and the chance of accomplishing perfect union
by the first intention, will be materially increased. Mr.
Lawrence has tried the plan in many instances, and his ex-
hperience has not detected any ill consequences whatever,
while it has proved, that many advantages are undoubtedly
the result of it. The method has been practised by many
of our military surgeons; and although they have proba-

bly not employed exactly such ligatures as this mode
absolutely requires, the greater part of them have met with
hardly any instances of future trouble from the bits of ligur-
ture enclosed in the wound. However, if large ligatures
be used, the practice is not fairly tried, or rather the practice
is not tried at all; because the great principle on which it
answers, is the very small atom of filk composing the extr-
aneous substance left in the wound, when such ligatures
as Mr. Lawrence particularly recommends are employed.

M. Delpech.
SURGERY.

M. Delpech, of Montpellier, and M. Roux, of Paris, have also sometimes adopted the new plan of removing the ends of the ligature close to the knot. See Parallèle de la Chir. Angloise avec la Chir. Françoise, p. 135.

Among other real improvements in modern practice, we must not forget the present more rational method of dressing the wound, after the majority of capital operations, with light cooling applications, instead of laying on the part a farrago of irritating pledgets and plasters, and a cumber-some mass of lint, tow, flannel, and other bandages, woollen caps, &c.,

The fewer the adhesive strips are the better, if they only hold the lips of the wound together. This is all they are intended to do. Whereas, if you apply more than are necessary for this purpose, they do harm, by heating the part, and covering the wound so entirely, as to prevent the diffusion of the discharge. Over the adhesive plasters, let the surgeon be content with placing a single pledge of spermaceti cerate, and some linen wet with cold water, which will often avert hurtful degrees of pain and inflammation, by keeping the parts cool.

Wars, which are unfavourable to most other sciences, are rather conducive to advances in surgery. The many new and interesting observations which M. Larrey has made in the course of his long and extensive military experience, are a proof of what we have been remarking. Ambroise Paré and General Windmill, the majority of whom are at the service of the army. To M. Larrey, we are indebted for many highly important observations relating to amputation in cases of gunshot wounds. In particular, he has added a larger and more convincing body of evidence, than was ever before collected, to prove, that in gunshot injuries, the operation of amputation should always be performed without the least delay, in every instance in which such operation is judged to be unavoidable, and the ultimate preservation of the limb either impossible, or beyond the scope of all rational probability. He has established the truth of this most important precept in military surgery by innumerable facts, drawn chiefly from his own ample experience, and partly from the practice of many able colleagues. The great operations of the shoulder-joint and hip-joint amputations, he has executed with success. The necessity for the former, however, he proves may sometimes be superceded, and the limb be saved, by making a suitable incision for the extraction of the splintered portions of the upper part of the humerus. This method, which was in many instances done with success in the peninsular war, was, we believe, originally proposed and practised by M. Boucher. (See Mem. de l'Acad. de chir. tom. ii. 410.) It was, however, more particularly described and even practised by Mr. C. White, of Manchester. (See his Caeae in Surgery.) Lately, it has been repeated with success by Mr. Morell, in the York hospital. See Medico-Chir. Trans. vol. viii.

Amputation at the hip-joint, performed only in the most dreadful cases, because it is itself the most dreadful operation in surgery, M. Larrey has performed five times, and twice with complete success. The method adopted by Mr. Browning, staff-surgeon, and Mr. Guthrie, deputy inspector of military hospitals, who in this way effected two recoveries. All these gentlemen, however, have had failures, and their successful attempts bear only a small proportion to the large number of deaths known to have followed amputation at the hip, in the many cases in which it has now been undertaken. We have no doubt, on the whole, that examples do occur, in which this severe operation is only means affording a chance of life; but we deem the chance so small, that it is to be hoped no surgeon will perform it, except under the authority of the united opinion of a board, or consultation of the best informed practitioners, whom circumstances will allow to assemble.

In the treatment of aneurismal diseases, English surgeons have much to be proud of. All the boldest operations are here the fruit of the spirit and skill with which this interesting part of surgery has been followed up in this country. The carotid artery, the external and internal iliac, and the subclavian, have all been successfully tied by British practitioners. We shall touch upon this subject, however, again in the sequel of this article. Scarpas' book on Aneurism, and Hodgson's Treatise on the Diseases of Arteries, merit the attention of every surgeon, as containing all that is at present known relative to this difficult and important branch of surgery.

The diseases of the eye, to which affections English surgeons seem to pay much less attention than was bestowed by foreign practitioners, now obtain due attention in this country. Although we have generally had some distinguished oculists, our surgeons at large have been wonderfully ignorant of this part of their profession, and uninformed in the subject, they have given up to professional oculists and quacks one of the most lucrative and agreeable branches of practice. However, the able writings of Daviau, Bevan, and Waire, begin to make the most of the specialty known among practitioners; and the observations of Scarpa, Richter, Wardrop, Saunders, &c. will soon have immense effect in diffusing in the profession, a due knowledge of the numerous diseases to which the organs of vision are liable.

As the practice of Mr. Saunders was unknown at the time when the article Cataract was -infected in this Cyclopaedia, we conceive that some account of it in this place may very well be introduced.

In the majority of cases of congenital cataract, after the lens has been converted into an opaque substance, it is gradually absorbed; and, in proportion as such absorption proceeds, the anterior and posterior layers of the capsule become approximated, and at length form one membrane, which is white, opaque, and very elastic. Among the exceptions to this order of events, is to be noticed a form of the congenital cataract, in which the centre of the lens is opaque, while the circumference is perfectly transparent. In such a case, the lens remains of its natural size, as long as its circumference preserves its transparency; but as soon as the capsule and lens are penetrated, even with the minutest instrument, the opacity spreads with rapidity. From this period, the bulk of the lens is diminished, with more or less celerity, according to the manner in which the wound has been made.

Congenital cataracts not only frequently attack children of the same parents; but, in this circumstance, are often precisely of a resembling constitution and nature. The lens may be either solid, soft, or fluid; but, more commonly, it is partially, or completely absorbed, and the cataract is capsular. Children, thus affected, partake of various degrees of organic changes. Some see external objects indistinctly; others can discern only bright colours, or vivid lights. If the blindingness is nearly complete, as the eyes are not attracted by any external objects, volition is not exercised over their muscles, their actions are not associated, and they roll about with rapidity, and tremble as they move.

In operating upon infants, Mr. Saunders used to overcome every difficulty by fixing the eye-ball with Feller's elevator; controuling the little patients by forceps, dilating the pupil with the belladonna; and employing a slender...
a slender needle, armed with a cutting edge from its shoulders to its point, and thin enough to penetrate with the utmost ease.

The extract of belladonna, diluted with water to the consistency of cream, was dropped into the eye; or, to avoid irritation, the extract itself was smeared over the eyelid and eyebrow. In about half an hour, and seldom later than an hour, the pupil is fully dilated, and the application must then be washed from the appendages of the eye. The child is now to be put on a table, parallel to a window, from which the eye, about to be operated upon, is farthest. Four assistants, and, when the child is stout, five, are required to confine it. The surgeon is to fit upon a high chair, behind the patient, with Pellier’s elevator in his left hand, and Mr. Saunders’s needle in his right, if it is the right eye on which the operation is to be done; or with the first instrument in his right hand, and the second in his left, if the operation is to be performed on the left eye.

Here it is necessary to state, that Mr. Saunders used to practise two operations; one is called anterior, in which the needle is introduced into the eye in front of the iris; the other posterior, the needle being introduced behind the latter membrane.

When the capsule contained an opaque lens, Mr. Saunders used gently to introduce the bow of Pellier’s elevator under the capsule, and then the needle, to a depth of the lower one. At the moment when he was about to pierce the cornea, he fixed the eye by making moderate pressure on it with the elevator. Such pressure was immediately discontinued, as soon as it was no longer needed. Mr. Saunders used to pierce the cornea, as near its junction with the sclerotics, as would allow the flat surface of the needle to pass in a direction parallel and close to the iris, without injuring this membrane. When the point of the needle had arrived at the centre of the dilated pupil, Mr. Saunders did not boldly plunge it through the capsule in the lens, nor perform any depressing motion. It was a material object with him, not to injure the vitreous humour, nor its capsule. Neither did he draw the capsule of the lens, with the point of the needle, towards the pupil; for it was an important part of his plan to avoid displacing the lens. On the contrary, he proceeded with a gentle lateral motion, working, with the point and shoulders of the needle, only on the surface and centre of the capsule, to an extent that did not exceed the natural size of the pupil. His purpose was to accomplish a permanent depression of this central portion of the capsule, and a simple puncture of it would not have answered the design. His next proceeding was to sink the needle gently into the body of the lens, and moderately open its texture.

Any inflammatory symptoms after the operation were opposed by the application of leeches, or even general bleeding. The extract of belladonna was also applied to the eyebrow, in order to keep the pupil dilated, and its edge out of danger of becoming adherent to the wounded capsule.

A simple operation sometimes sufficed, nature producing a disfollution and absorption of the opaque lens. On other occasions, one or more repetitions were necessary, an interval of at least a fortnight being always suffered to elapse between every two operations.

Fluid cataracts of the congenital kind are the least common, and when these cases are met with, the surgeon, after puncturing the capsule, and letting its contents mix with the aqueous humour, is to do no more for the present, but take the requisite steps for averting inflammation. The cæafe is thus changed into a capsular cataract.

When the capsule was opaque, the lens having been nearly, or quite absorbed, the practice of Mr. Saunders authorized a freer employment of the needle; though in the manner already detailed. When any portion of the lens remained, as a small nucleus in the centre of the capsule, his efforts were exclusively directed to the detachment of this portion, in order to effect a permanent aperture in the centre of the capsule. When this membrane alone prevented itself, his main plan was to form an opening in the middle of it.

When Mr. Saunders practised his posterior operation, for a capsule containing an opaque lens, he introduced the needle, in the common way, through the sclerotics. He then gently depressed its handle, so as to direct its point towards the capsule, through the thin edge of the lens; and, pushing the flat surface of the instrument between the capsule and the lens, he carried it as far as the centre of that membrane. Here he opened the capsule, taking care not to tear it extensively, lest he should dislocate the lens. He then cautiously opened the texture of the lens, and withdrew the needle. In repeating the operation, his aim was to complete the central opening in the capsule, and look to the texture of the lens. Small flecks were allowed to fall into the anterior chamber; but he endeavoured to avoid forming large fragments either.

When the posterior operation was done, and the eye was an opaque capsule, the lens having been nearly, or quite absorbed, the needle was introduced in a direction obliquely backward, in order to avoid the iris, which, in consequence of the absorption of the lens, was liable to be situated further backward. Any remnant of the lens was set detached; and then the same manœuvre were adopted, as in the anterior operation or capsular cæafes. The capsule was often so yielding, that a backward or depressing motion of the needle was sometimes necessary to rend its centre. It appears, that Mr. Saunders finally gave a preference to the anterior operation, which inflicted lighter injury on the eye, did not disturb the ciliary processes, or vitreous humour, and was less apt to excite inflammation.

The success of this gentleman’s practice may be conceived, when it is known, that of fifty patients, he relieved fifty-two to fight by his mode of operating. He operated both on infants and adults. It is observed, also, that his attempts were most successful in children between the age of eighteen months and four years.

In the modern practice of surgery, a variety of old prejudices are gradually vanishing. Peruvian bark, not many years ago, was regarded as a sovereign remedy and pledge for nearly all cases of gangrene; and in thefe and other infirmities was prescribed without any discrimination, and in doses beyond all moderation. But the false idea the this medicine has any specific effect in checking mortitude, no longer blinds the senses even of the ordinary practitioner. He neither believes this doctrine, nor the still more absurd opinion,
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opinion, that strength can be mysteriously extracted from this vegetable substance, and communicated to the human constitution in proportion to the quantity which can be made to remain in the stomach. This subject, however, we have duly discussed in the article GANGRENE. The authority of a very distinguished professor may be added to what has there been urged upon this important topic. "I think," says Dr. John Thomson, "I have frequently seen it (bark) prove hurtful when administered in cases of mortification, by loading the stomach of the patient, creating a dislike to food, and sometimes by exciting an obstinate diarrhoea. I believe it to be, in mortification, a medicine completely inert and inefficacious." Lectures on Inflammation, P. 153.

The removal of this deeply-rooted prejudice concerning the virtues of bark in floribund mortification, will pave the way to better and more successful practice.

But upon the subject of mortification, the present day opens to us the investigation of a point which is of the first-rate consequence. Every surgeon is aware, that when a limb is feased with mortification, amputation is sometimes absolutely necessary to effect a cure. This is generally acknowledged; but the performance of the operation has, since the time of Mr. Port, only been fashioned when the mortification has manifestly ceased to spread, and a line of separation has formed between the dead and living parts.

All other inferences, in which the disorder was in a spreading state, were left to their fate. It is true, some of the old surgeons occasionally ventured to deviate from this precept; but as they did so without any discrimination, or knowledge of the particular examples which ought to form an exception to the general rule, their ill success cannot constitute a just argument against the plan of amputating earlier in a certain description of cases.

Now if modern experience can prove that many lives may be saved by a timely performance of amputation under circumstances in which it has until lately been generally condemned, we must allow that the established innovation will be one of the greatest improvements in the practice of the present time.

For reviving the consideration of this question, and venturing to deviate from the beaten path, the world is much indebted to that eminent military surgeon, M. Larrey. How different his doctrines and practice are from those usually taught by surgeons, the following extract from his writings will sufficiently prove.

"Writers on gangrene, or phæclus of the extremities," observes M. Larrey, "indiscriminately recommend the amputation of a phæclated limb never to be undertaken before the mortification is bounded or limited by a reddish circle, forming a true line of separation between the dead and living parts. This circumstance can only occur in a case of spontaneous gangrene from an internal cause; or if it happens, as is very unusual, in a case arising from a wound, its progress is different, and it would be exceedingly imprudent to wait for it. "The gangrene from external injuries almost always continues to spread; the infection becomes general; and the patient dies." (Larrey in Mem. de Chirurgie Militaire, tom. iii. p. 142.) On the other hand, this author affirms, that, in the dry or spontaneous gangrene, absorption takes place with more difficulty, and it is not uncommon to see the phæclated parts separate from the living ones by the powers of nature alone, without the general functions being impaired. He argues, that there is a manifest difference between what he terms the traumatic, and the spontaneous gangrene, or, in other words, between the humili gangrene from an external cause, and the dry gangrene, which ordinarily proceeds from an internal cause.

In cases of mortification arising from external injuries, M. Larrey maintains, that, "notwithstanding anything that writers and practitioners may allege to the contrary, we should not hesitate about promptly performing amputation, as soon as the necessity for the operation is distinctly established. There is no reason to apprehend that the stump will be feased with gangrene, as in the spontaneous mortification, that has not ceased to spread, because the traumatic gangrene, after having arisen from a local cause, is only propagated by absorption, and a successive affection of the texture of parts by continuity of the vessels. Amputation, performed in a proper situation, stops the progress and fatal consequences of the disorder.

"Supposing then the lower half of the leg should be affected with phæclus, in consequence of a gun-shot injury, attended with a violent contusion of the part, and a forcible concussion of the vessels, nerves, and ligaments, if the skin is elsewhere uninjured, the operation may be done in the place of election, without any fear of the stump becoming gangrenous, notwithstanding the cellular membrane of the upper part of the member may be already affected. But when the skin of the whole leg is struck with mortification, the operation must be done on the thigh, and no part should be lost. The same practice is applicable to the upper extremities. We must be careful not to mistake a limb affected with tæpor for one that is actually phæclated. In the first case, warmth, motion, and sensibility are still retained, although the skin may be blackish, and the parts may be swollen. Besides, if there were any doubt, it would be proper to try at first tonic repellent applications, and cordial medicines, &c." Larrey in Mem. de Chirurgie Militaire, tom. iii. p. 152, 153.

When amputation has been practised, this author recommends the exhibition of bark, good wine, tonics, &c. in order to promote the good effects of the operation. P. 154.

"The facts," says M. Larrey, "which I shall relate in the course of this dissertation, will prove, I think, in an incontrovertible manner, the truth of the principle which I lay down, that, "when gangrene is the result of a mechanical cause, and puts the patient's life in danger, amputation ought to be performed, without waiting until the disorder has acquired a tendency to spread."

"I have been a witness of the death of several individuals, from too rigorous an adherence to the contrary precept; and at length grievously impressed with this loss, I had long ago determined to depart from an axiom which was always considered by me as false. Besides, following the maxim of Celsus, I preferred employing an uncertain remedy, rather than abandon the patient, to an inevitable death. "Satius effem animae auxilium experi quam nullum."

"I made the first attempt at Toulon, in the year 1796, upon a soldier, who, in consequence of a violent contusion of the foot, was afflicted with a gangrenous ulcer, which soon threw the whole limb into a phæclaked state. While the mortification was yet spreading, I resolved to amputate the leg. The success of the operation surpassed my expectations; the stump healed; and, in less than forty-five days, the patient got quite well. This case served to encourage me.

"During the siege of Alexandria, in Egypt, in 1801, a second case, very analogous to the preceding, occurred in my practice; it happened in a dragoon of the 15th regiment, whose fore-arm and afterwards phæclated, in
consequence of a gun-shot wound in the articularization of the left arm. The mortification had extended nearly as high as the shoulder, and the patient's life was in great danger, when I determined to amputate the limb at the shoulder-joint. The disorder was manifestly spreading, and the patient's brain already affected, for he had symptoms of ataxia: the operation, however, arrested the progress of the spreading, and saved the patient's life, who, at the conclusion of the disease of Alzheim, was quite cured.

"After the taking of Ulm, M. Ivan, surgeon to his majesty the emperor, performed in my presence, and at my ambulance established at Elchingen, the amputation of the thigh of a soldiery belonging to the 76th regiment of the line, the leg having fphacelated, in consequence of a gun-shot injury. The gangrene was not limited, and evidently continued to extend itself; notwithstanding this, the effects of the infection were destroyed, and the patient was quite cured on our return to Aufterlitz.

"A fourth patient, an officer in the fame regiment, foot in the ankle, at the capture of the fame town, was conveyed to my ambulance, in order to be dressed: it was the third day after the accident; the foot was gangrenous, and the leg was swelled, and threatened likewise with infection. Febre symptoms had also come on. I hastened to amputate the leg a little above the place of mortification. The cellular membrane of the stump, of a yellow blackish colour, was already infected with the gangrenous principle, (as M. Larrey terms it.) The operation, however, stopped the progress of the mischief; suppuration took place in the stump; some fluid was collected; the wound as it had a cleaner appearance; and cicatrisation was completed on the 5th day. The patient could already walk with a wooden leg, when he caught the hospital fever, which was epidemic at Ulm, where he awaited his regiment, and, to my great regret, he was carried off by this disease, after having escaped the former danger.

"After the battles of Aufterlitz and Jena, (continues M. Larrey,) several of my colleagues, surgeons of the frst class, undertook, in consequence of my advice, and the example of the French, with which I had accosted them, the amputation of limbs equally fphacelated, although the mortification was not limited, rather than abandon the patients to a death which appeared inevitable. In general, these practitioners experienced the fame success as I did myself." Larrey, in Mem. de Chirurgie Militaire, tom. iii. p. 154.

In M. Larrey's memoir upon this subject, there are some additional facts and arguments in favour of what he endeavours to prove, viz. that in cases of mortification from external injuries, if the patient's life is in danger, amputation ought to be performed, although the mortification may yet be in a spreading state. We must be content, however, with having stated the particulars already explained; and the reader desirous of more, must refer to M. Larrey's own publication. Certainly, the facts which this gentleman has adduced are highly important: they tend to subvert a doctrine, and to prove the error of a practice, which have been urged in most forcible terms by all the distinguished surgeons of modern time. The sentiments of Mr. Sharp are rendered questionable; and the truth of the positive assertions of Mr. Pott is yet a matter to be examined. The latter, it is well known, tells us, that he has often seen the experiment made of amputating while a mortification was spreading, but never knew it answer. Are we to conclude, that all these cases which Pott alludes to, were mortifications from an internal cause? Or are we to suppose that the operations failed from having been delayed too long? Or must we imagine that the nature of the human constitutions has been changed between the era of Mr. Pott and that of M. Larrey? The last gentleman's facts are too well substantiated to admit of being disbelieved.

Mr. Lawrence, ever ready to give every laudable proposal the fairest trial, undertook amputation at the shoulder-joint in a spreading mortification of the arm, in consequence of external violence, and was quite successful. He had the pleasure of seeing his patient recover in the most favourable manner. See Medico-Chirurg. Trans. vol. vi. p. 184.

"The issue of the preceding case," says this gentleman, "clearly proves, that that humid kind of gangrene which occurs in a healthy subject from severe local injuries, which rapidly affects, or rather infects, a whole limb, and reaches the trunk in a few hours, must constitute one of the exceptions to the maxim of not amputating till the mortification has actually stopped. It may, indeed," says Mr. Lawrence, "be slated generally, that the operation, even if painful should be deemed hazardous, offers the only chance of life; and that without it, the patient's fate is certain. I would not be underfoot as meaning to recommend the practice in all instances of mortification from local injury. I can conceive that a gangrene may arise, in an unfounded constitution, from a comparatively slight accident, to that it may be regarded as the result of constitutional disposition, rather than of the local cause. Amputation, would be hopeless under such circumstances. I have in view the mortification following a very severe injury, in a subject otherwise healthy." Lawrence in Medico-Chirurg. Trans. 1809.

This gentleman has also mentioned another successful example of amputation, while a mortification from a wound was in a spreading condition.

The writer of this article was consulted, only a day or two ago, whether amputation was proper under the following circumstances. A matter glistening, a strong man, about forty years of age, slipped down a ladder with his feet forward. When he had descended some yards, the end of a spear-shaped iron railing came into violent contact with his arm, at the elbow, where it lacerated the skin, though not extensively, and wounded the brachial artery. Two hospital pupils, who happened to be in the street where the accident occurred, immediately secured the wound. The patient was conveyed home, and treated as the antiphlogistic regimen. In the course of thirty hours, however, the limb became gangrenous, being affected with considerable oedema, livid discoloration, and a large phlyctena on the fore-arm. The patient's countenance was beginning to put on a cadaverous appearance; his pulse was small and rapid, not less than 120, and irregular; and he was covered with profuse perspirations. He was also affected with a remarkable degree of fluoror, which made him seem to forget even his nearest friends and relations. As the mortification arose from great external violence, and the shoulder was not yet gangrenous, the author of this article concided in the propriety of attempting to save the man's life by amputation at the shoulder-joint, which was done without delay. He cannot at present state the result; but the patient bore the operation well, and what is particularly worthy of remark, the fluoror appeared to leave him the moment the limb was removed; for he immediately recognized his wife, and entered into rational conversation with his friends. In the evening after the operation his pulse was ten strokes less in a minute, and somewhat stronger; and he was in no particular pain. Indeed, there was every reason to expect that the case would end well. Since
Since the article Aneurism was written, many interesting observations have been published, and the boldness, skill, and success, with which operations are now performed in this country for the cure of that disease, are such as astonish and even stagger the belief of the French and other continental surgeons. We therefore propose to conclude this article with a few remarks, explaining some particulars which have not had a previous opportunity of laying before the reader.

Internal aneurisms have generally been considered beyond the reach of surgery. Debilitating remedies, abstinence, a salt diet, occasional bleedings, and the avoidance of all exertion, have been the means commonly recommended, rather with an expectation of retarding the disease, than of effecting a cure. The facts, however, which modern experience has added in favour of the efficacy of a treatment first proposed by the celebrated Valisalva, are certainly such as to justify a confident belief, that many internal aneurisms, even though large and much advanced, are capable of palliation, reduction, and cure. The cases recently published by M. Pelletan, surgeon to the Hotel Dieu, at Paris, furnish the most convincing evidence, that vaft aneurisms of the aorta, so large as to project through the abridged part of the ribs and sternum, may sometimes in a very moderate time be reduced and cured by Valisalva's method. This chiefly consists in bleeding the patient largely and repeatedly; in allowing only the most spare diet, nothing in fact but broth and acid drinks; in applying ice, or compresses wet with a cold lotion of vinegar and water, to the swelling; and, lastly, in enjoining a strict observance of silence and quietude. The quantity of blood that has been taken away in these cases is really astonishing; some of the patients, for the first few days of the treatment, have been bled several times a day. Besides aortic aneurisms, M. Pelletan effectuated the cure of a subclavian aneurism by pursuing Valisalva's treatment. See Clinique Chirurgicale, par J. P. Pelletan, tom. i. Mem. fur les Aneurismes internes, Paris, 1813.

But external aneurisms are the cases, in which the power and utility of surgery are strikingly displayed, and for which its aid is commonly demanded. With respect to these cases, we must notice, that they do sometimes undergo a spontaneous cure, in consequence of the artery affected becoming impervious, and no longer communicating with the cavity of the aneurismal sac. This beneficial change may be the effect of the preffure of the swelling itself on the vessel. It is sometimes produced by the skilful employment of compression. But there is another mode, in which a spontaneous cure of external aneurisms sometimes happens: When the tumour has become large and tense, it suddenly falls into an inflamed and gangrenous state, and the inflammation extending its effects to a sufficient depth, the artery, where it communicates with the aneurismal sac, is rendered impervious. At length the mortified parts, together with the mass of blood in the tumour, are cast off, and, if the patient's constitution holds out, a cure ensues. We have known an instance of an axillary aneurism getting well spontaneously without any inflammation or lancing. We have seen an inguinal aneurism, under Mr. Albert, get well by the tumour mortifying; and the inflammation extending to the artery. Whenever the lancing and inflammation are only superficial, and confined to the skin and sac, the patient bleeds to death on the detachment of the mortified part. But notwithstanding some patients are fortunate enough to have a spontaneous cure, this event is too rare to sanction much expectation of it, or to justify a surgeon in withholding his assistance.

Setting out of the question Valisalva's method, the ordinary principle on which aneurisms are cured, consists in preventing the entrance of fresh blood into the aneurismal sac; for when this is effectually accomplished, the blood already contained in the sac is gradually absorbed, and the tumour diminishes in proportion.

This object, as we have observed, may sometimes be fulfilled by a skilful application of pressure, provided the aneurism be small, and the whole of its contents can be made to recede: However, though it is generally proper to try preffure in the early stage of the disease, it cannot be said, that such practice is attended with much success. If the communication between the aneurismal sac and artery does not become obliterated in consequence of this means before the end of a fortnight, there is no great reason to expect that it will do so in a longer time. The inanities recorded of aneurisms being cured by a long perseverance in preffure, are probably cases which would naturally have got well without this means.

We shall not repeat a description of the mode of operating for the common popliteal aneurism. There is one remark, however, recently made by professor Scarpas, which we conceive to merit particular notice. He advises surgeons to make the incision in the upper third of the thigh, or a little higher than the situation which Mr. Hunter chose. His reasons for this are, to avoid the necessity of removing the sartorial muscles too much from its position, or of turning it back for the purpose of exposing the artery and tying it. The bell-shaped, even professed anatomists, are frequently embarrassed by having the sartorial muscles immediately in their way, after they cut through the skin. Also, as the artery is more superficial higher up, and lets likely to be in a morbid state, there is every consideration in favour of this part of Scarpas's practice.

Mr. Abernethy has rendered surgeons more confident in the success of operations for popliteal aneurism, by his bold, yet judicious attempts to cure aneurisms situated in the groin. Several times has he tied the external iliac artery, and effectually that the inoculations, even in this high situation, are quite sufficient for conveying a due quantity of blood into the limb below. By one of these attempts, he preferred the life of a peron, who, without the operation, would certainly have been hurried into the grave in a very short time by the rupture of the tumour. Similar operations have since been performed with the most successful consequences by Mr. Freer and Mr. Tomlinson, of Birmingham, Mr. Atley Cooper, Mr. Lawrence; and by several other surgeons in Ireland, France, and America.

The plan of doing it is simple, and consists in making an incision, about three inches in length, through the integuments of the abdomen, a little above Poupart's ligament, and half an inch on the outside of the abdominal ring, in order to avoid the epigastric artery. The aponeurosis of the external oblique muscle is then to be divided in the direction of the wound. The lower margin of the internal oblique and transverse muscles is also to be cut with a crooked bistoury. The finger may then be passed under the peritoneum, by the side of the psoas muscle, so as to touch the artery. A double ligature is to be carried under the vessel, and tied as in the operation for the popliteal aneurism, tightly enough to divide the inner coats of the artery.

The several operations, in which the external iliac artery has been tied, all tend to prove how sure the limb is of having an adequate supply of blood through the anastomosing vessels. The cases might almost warrant the conclusion, that the limb is in no more danger of mortifying on
Surgery.

This account, when the artery is tied above Poupart's ligament, than when tied low down in the thigh. No doubt, still greater success would follow such operations, if they were generally undertaken at an earlier period, before the tumours have become very large, and the health impaired by confinement. The fact, that the anatomomies are always fully adequate to carry on the circulation in the limb, being now well established, there is no excuse for delaying the operation, for the purpose of affording time for the dilatation of the anastomosing vessels. The first day after the operation afforded hopes of a cure; and the circulation in the fore-arm was returning; but a difficulty of breathing afterwards came on, the limb mortified, and the patient died on the fifth day. Doubtless this patient would have had a much better chance of preservation, had the operation been performed earlier, before a tendency to mortification began in the arm, and had the wound been closed with flichting-plaster, according to the most approved principles. At the same time, it must be confessed, that diffused false aneurisms are the most dangerous of all those which admit of observation, particularly when the arteries interposed are of large size. The injection of an enormous quantity of blood into the cellular texture, proves both an impediment to the free circulation in the limb, and a frequent cause of gangreneous symptoms, in addition to the obstructions to the passage of the blood through the main artery, occasioned by the ligature.

It appears that Mr. Keate has also tied the axillary artery by cutting below the clavicle. The ligature, however, which was passed with a needle, did not include the vessel by itself, as is most desirable. This operation proved entirely successful. See Med. Rev. and Mag. for 1801.

Mr. Pelletan, in 1786, had under his care a man, in the Hospice du Collège de Chirurgie at Paris, who was afflicted with an axillary aneurism, which had existed two years. The swelling occupied the whole axilla, advanced under the great pectoral muscle, and descended even below the nipple, while, behind, it pushed back the humerus, and appeared engaged under the front edge of the deltoid muscle. But, on the shoulder being raised, a considerable space was left without any aneurism. The true manner in which the artery could be felt under this bone, when the shoulder was elevated, and the case with which pressure on the vessel sufficed for stopping the pulsation of the swelling, seem to have induced Pelletan to think of operating. He was further encouraged by considering that the branches given off by the subclavian artery were numerous, as well as their communications with the branches arising from the axillary and brachial trunks.

Pelletan had made up his mind to divide the integuments below the clavicle the whole length of that bone, and, after passing a directeur under the clavicular portion of the pectoral muscle, to detach this part from the whole of its connection with the preceding bone. Thus he intended to have exposed the axillary artery, so as to have been able to apply a ligature to it. Unfortunately, some other surgeons, called into consultation, objected to the project of dividing the pectoral muscle; and Pelletan was foiled, after making in vain a deep and hazardous thrust with the needle, in the hope of being able to include the artery. The patient was afterwards feigned with inflammation and pain in his chest, and died on the twentieth day from the operation. Cliniques Chir. par J. P. Pelletan, tom. ii. p. 49.

In a periodical work, we find brief mention made of another case, in which the subclavian was tied on account of an axillary aneurism. The mode of operating is not stated; the object is said to have been easily accomplished; but the
Surgery.


In the whole, perhaps, the method adopted by Defaut is the safest, when the operation is to be attempted below the clavicle. There is another mode, however, which seems practicable.

An incision about three inches long, might be made through the integuments, a little below the clavicle, and immediately over the hollow between the deltoid and pectoral muscles. The axillary vein lies before the artery, and as a wound of it would probably be fatal, the utmost caution must be observed in the division. Care must also be taken not to mistake one of the cervical nerves for the artery. With an eye probe, a ligature is to be put under the vessel, as soon as it is distinctly ascertaind to be such, and the vein and any adjacent nerve should be carefully excluded. No man ought to undertake this operation, who is not a steady operator, and is not well acquainted with the anatomy of the parts. If the aneurismal tumour, however, should extend far inward, toward the sternum, this plan of operating would not be practicable.

Thus far of the mode of tying the axillary artery by cutting below the clavicle. When the aneurismal tumour extends far inward towards the sternum, the only place where the subclavian artery can be taken up, is just where it emerges from the chest, from behind the anterior scalene muscle, and the object can only be effected by cutting above the clavicle. On a dead subject, having no large aneurismal swelling, such an operation is much easier than on a living person, whose clavicle is pushed up by a vast tumour, so as to increase the distance between the artery and the wound in the skin. The most interesting example of this operation lately occurred in St. Bartholomew's hospital.

Mr. Ramden made a transverse incision, about two inches and a half in length, along and upon the upper edge of the clavicle. The cut was begun on the side towards the shoulder, and ended about half an inch from the outer edge of the sterno-clido-mastoideus muscle. This incision divided one small artery, which was immediately secured. The skin above the clavicle was then pinched up, and divided from within outwards and upwards, in the line of the external edge of the sterno-clido-mastoideus muscle, to the extent of two inches. The shoulder was now lowered, and the edge of the anterior scalene muscle exposed. The artery was then distinctly felt, presenting itself from between the scaleni, and it was detached with the finger-nail, in order that the ligature might be passed round it. Here some considerable difficulty arose, as Mr. Ramden was not provided with any kind of aneurismal needles that would allow their points to be brought up again, in the very short curvature which the narrowness of the space between the rib and the clavicle afforded. Though the ligature could be conveyed under the artery, it could not be got round the vessel. At length, a probe of duck's metal was got under the artery, and by this means a ligature was drawn under the vessel. The usual knot was then made. This patient lived five days after the operation, and, on division, nothing but the artery was included in the ligature. This case fully proved, first, that the arm may be duly nourished with blood, and suffer no diminution of its temperature, though the subclavian artery is tied immediately it comes out of the chest. Secondly, it proved, that an artery so near the heart as the subclavian, may be rendered impervious by the ligature, as, on division, this vessel, where the cord was applied, was nearly divided through, while the two ends were found coagulated and closed. See Obs. on Sclerocele, &c. by T. Ramden.

The judgment that we formed from the observation of this case, was, that in all probability a complete cure would have taken place, had the man chanced to submit to the operation before the tumour began to slough, and before the health was materially impaired; and had the operation itself been shortened and facilitated by the affixation of the needles represented in Mr. Ramden's publication.

These instruments undoubtedly resemble, in principle, Defaut's sanguine a retors, which consisted of a silver sheath, one end of which was straight, and the other curved in a semi-circular way. This sheath enclosed an elastic wire, one end of which projected a little beyond the bent end of the sheath, and had a transverse eye in it, for the reception of the ligature. The instrument being introduced under the artery, the sheath was kept fixed, while the elastic wire was pulled through it, till the transverse eye had ascended sufficiently to let the surgeon take hold of the ligature. This being disengaged from the instrument, the latter was withdrawn. The needle invented by Mr. Watts appears to us rather an improvement on Defaut's, inasmuch as it is made to let loose the eye and ligature together, as soon as they are conveyed far enough round the artery; a contrivance likely to save some little trouble.

Aneurismal needles, made on the foregoing principles, must certainly afford great assistance to any future operator who may attempt to tie the subclavian artery from above the clavicle, as they obviate the chief difficulty, namely, that of getting the ligature quite round the vessel.

It was this difficulty which baffled Mr. Asley Cooper in one attempt which was made some time since in Guy's hospital. London Med. Rev. vol. ii. p. 300.

Nothing is more possible than to mistake one of the cervical nerves for the subclavian artery, in consequence of the pulsation of this vessel being communicated to all the adjacent parts. We have been a mistake of this kind actually made by very skilful surgeons.

Pelleton practised on the dead subject the following method: the head was turned to the opposite side, and the shoulder lowered as much as possible. An incision was then made along the neck, at the back of the sterno-clido-mastoideus muscle, so as to bring into view the scaleni muscles. The anterior portion of these muscles being divided, a ligature was conveyed without difficulty under the subclavian artery, with the aid of an aneurismal needle, mounted on a handle, made by the French to have been invented by Deflambres. (Clinique Chir. tom. ii. p. 86.) With the exception of cutting the anterior scalenus, which seems unnecessary, Mr. Aberdeen has demonstrated in his lectures a similar operation thesfe many years past.

That the carotid artery might become obliterated, without any dangerous effect on the brain, and that an aneurism of the same vessel might undergo a spontaneous cure, was long since proved by the case related by Petit, who, on the patient's decease some time afterwards, found the right carotid obliterated from its bifurcation, as far as the subclavian of the same side. But, besides this kind of obliteration by a process of nature, modern experience has evinced, that the carotid artery may be suddenly tied with a ligature, and thus rendered impervious, without any pernicious consequences on the brain. In one instance, indeed, where Mr. Aberdeen was obliged to take up the carotid artery, the head seemed to be affected; but then the patient had lost an almost fatal quantity of blood; and had an immense lacerated wound of the neck, in consequence of being gored with a cow's
Surgery.

In the work referred to below, Mr. A. Cooper has recorded another case, where he tied the carotid artery; but the aneurism being too far advanced, and an abscess arising, the patient died from the prejudice produced on the throat. M. Burckhardt of Stockholm, is also stated to have operated for a carotid aneurism; but the result was not known. Mr. Cline has likewise taken up the carotid artery for an aneurism, which seems to have been attended with unpleasant circumstances: the patient died in about three days after the operation. London Med. Rev. vol. ii. p. 96.

Another successful instance, in which the carotid was tied for the cure of an aneurism, is related in a work, to which we always have the greatest pleasure in referring. See Hodgson’s Treatise on the Diseases of Arteries, p. 59.

In order to get at the carotid artery, Mr. Abernethy has recommended making an incision on that side of it just below the trachea, where no important parts can be injured, and the best method to pass a finger under the vessel. The par vagum must be carefully excluded from the ligature; for tying it would be a fatal blunder. See First Lines of the Practice of Surgery, by Samuel Cooper, edit. 3.

We might mention many other examples in which the carotid artery has been successfully tied; but the safety of the surgeon must say to us, that we are not able to authenticate that the operator took away a large tumour, including the whole of the parotid gland, from the side of the neck, without the smallest risk of hemorrhage. This mode of proceeding was adopted by Mr. Goodlad, surgeon at Bury, in Lancashire. See Medical Chir. Tran. vol. vii. p. 112.

We shall conclude with some interesting particulars, relative to another case of cure in surgery; we mean that of tying the internal iliac artery.

The gluteal artery is large; from its situation liable to wounds; from its size, subject to aneurism. Dr. Jeffry of Glasgow, was consulted in a case where the gluteal artery had been wounded. He urged the propriety of tying the vessel where it had been injured. This sensible advice was at first rejected, and when the friends at last consented, the operation was too late, as while preparation was making for it, the tumour burst, and the patient expired in a few moments. Mr. John Bell, however, had a case, in which he tied the gluteal artery, which had been wounded, and the patient was saved.

Mr. Stevens, surgeon in Santa Cruz, the gentleman who has proved the practicableness of putting a ligature round the internal iliac artery, informs us, that “one of the few surgeons in London had a patient with gluteal aneurism. The operation was undertaken, after preparation was made for it, the tumour burst, and the patient died.”

“I sincerely trust, that the following case may be a means of preventing such an occurrence in future.”

“Mallia, a negro-woman from the Bambara country in Africa, was imported as a slave into the West Indies in the year 1790. She was purchased for the estate Esteban Green; now the property of the heirs of P. Ferris, on the island of St. Christopher. She was first seen in the beginning of December, 1812. She had a tumour on the left hip, over the ischial notch. It was nearly as large as a child’s head, and pulling strongly. She could afford no cause for the disease. It had commenced about nine months before, with slight pain in the part, and had gradually increased to its present size. She...
Donat Surian, a celebrated physician and botanist at Mar-

elles, who accompanied Plummer in his travels to America.


Storz. Obl. 185. Lamer. Dict. v. 7. 523. Clas and orde,


Refl. Jaff.

Gen. Ch. Cal. Perianth inferior, permanent, of five,

c lanceolate, pointed leaves. Cor. Petals five, obovate,

spreadings, the length of the calyx. Stam. Filaments ten,
normally only five, thread-shaped, shorter than the corolla;

anthers simple. Pith. Gernens five, superior, roundish;

styles solitary, thread-shaped, erec, as long as the flaman,
springing from the sides, not the tips, of the gerns, flag-


Eff. Ch. Calyx of five leaves. Petals five. Styles in-
serted at the sides of the gerns. Seeds five, naked.


Pfund. t. 40. (Arbor americana, falcis folio, strangula

bermuidiensis; Pluk. Alm. 444. 5. 241. f. 5.)—Native of

the sea-coast in South America and the West Indies.—Root

perennial. Stam. shrubby, five or five feet high. Branches

erec, subdivided, round, rough, glaucous, downy. Leaves

short, flalks, clutered at the summits of the branches,

wedge-shaped, obtuse, thick, downy, or somewhat pil-

lous, pale green. Flowers small, yellow, gernally from

two to three, on a terminal, axillary flalk, which is shorter

than the leaves.

SURIGUR, in Geography, a town of Hindoostan, in

Bihar; 26 miles W.N.W. of Rotaigur.

SURINAM, a province of the Dutch Guiana, (which fee)
deriving its name from that of a river, on which the capital,

Paramaribo, is situated. It is bounded on the N. by

the Atlantic, on the E. by the river Marawina or Maroni,

on the S. by a country of Indians, and part of French

Guiana, and on the W. by the river Corentyn; about 150

miles from E. to W., and 60 from N. to S. The prin-
cipal rivers that belong to this settlement are the Surinam,

the Corentyn, the Elquino or Eloquino, which at its mouth

receives the Demerara, Berbice or Berbix, giving name to

a colony, the capital of which is Amsterdam, the Comme-

wijn, and the Maroni.

The banks of creeks or rivulets that recharge themselves in

these rivers are inhabited by Europeans, and cultivated with

fugar, cocoa, cotton, coffee, tobacco, and indigo plantations, which present a very
delightful prospect to the water-passengers. Captain Sted-

man says, that the province of Surinam has from six
eight hundred plantations of this kind, which produce an-
ually to the value of more than a million sterling. He

computes the number of slaves at 75,000, the annual supply

being 2500. The heats in this colony are tempered by

breeses from the sea, and are thus rendered more tolerable

than those of Guinea, situated like Guiana in the torrid

zone. The soil is, in general, very fertile; and all the ap-

pearances of fertility may be ascribed, not only to the rains

and warmth of this climate, but also to the low and marshy

situation of the country, which prevents the intense heats

from destroying vegetation, and to the extreme richness of

the soil, particularly in those parts that are cultivated by

European industry. Such situations, however, are by no

means favourable to health. The unevacuated parts are

furnished with immense forests, rocks, and mountains; some of

the latter enriched with a great variety of mineral substances;

and the whole country is intersected by very deep marshes

and swamps, and by extensive heaths or savannas. The stream

along the coast flows continually towards the N.W., and

...
the whole shore is rendered almost inaccessible, from its being
encircled with dunes, sandhills, banks, quicksands, bogs and
rocks, with prodigious bushes, and a large quantity of
brush-wood, which are so closely interwoven as to be impenetr-
able. That part of Terra firma which is called Guiana,
or the Wild Coast,” and in which lies the colony of
Surinam, is laid by some to have been first found out by the
jauntily celebrated Christopher Columbus, in the year 1498,
when he was sent home in chains; though others contend,
that it was not discovered till the year 1504, by Valco
Unes, a Spaniard. In 1579, it was visited by Sir Walter
Raleigh, under queen Elizabeth, who also sailed up the
river Oroonoko above 600 miles, in search of the supposed
El Dorado, and in hopes of discovering the gold mines
of which he had the most lively expectations, from samples
of maracaste, which the Spaniards call madre de oro.
In the year 1634, a Capt. Marshal, and about sixty English,
were discovered in Surinam, employed in planting tobacco,
according to the relation of David Piteale de Vries, a Dutch-
man, who converted them with the spot. In 1649,
Surinam was inhabited by the French, who were obliged to
leave it soon after, on account of the frequent invasions
which they justly suffered from the Caribbean Indians, for
having, like their neighbours the Spaniards, treated them
with the most barbarous cruelties. In the year 1650, this
colony being vacant, Francis lord Willoughby of Parham,
by king Charles II.'s permission, went there with some
vessels, equipped by himself, to take possession of it, in the name of
his royal master; a little after which he dispatched three
vessels more, one of them carrying twenty guns. All these
were well received by the Indians or inhabitants of the
country, with whom they entered into friendly treaties, and
a kind of negotiation. In the year 1662, the colony of
Surinam was granted by charter of Charles II. to Francis
lord Willoughby, and at that lord's desire, to be divided
with Laurence Hyde, second son of Edward, earl of Claren-
don, for them and their descendants for ever. In the
year 1665, Surinam was successfully cultivated, mostly by
planting tobacco. They had also raised above forty fine
fugitive plantations, and erected a strong fort with hewn stone
for their defence. It is proper, however, to remark, that
some improvements were effected by the Portu-
guese, though at what period is uncertain; while the French
strenuously dispute the point, and insist that they
were the work of Monseigneur Ponfray de Bretigny, when
France had possession of that country. However this may
be, the fort is situated about 16 or 18 miles from the
mouth of the river Surinam; and these industrious settlers
found themselves perfectly happy in a small town which
they had built under the walls. Their felicity was not of
long duration; for in the wars between Charles II. and
the United Provinces, the Dutch, having been driven, in 1661,
from the Brazil by the Portuguese, took the colony of
Surinam from the English, in 1667, under the command of
a captain Abraham Crivou, who was dispatched for that
purpose with three ships of war and 300 marines. The
English commander, William Biam, looted the settlement of
Surinam by surprise, when above 600 of the belt men in the
colony were at work on the sugar plantations. This neglect
appears from the trifling loss of the Dutch, who in forming
the citadel had but one man killed. They immediately
planted the prince of Orange's flag on the ramparts, and
gave now to this fort the name of Zeelandia, and that of
Middleburgh to the town of Paramaribo, after making
the inhabitants, among other contributions, pay 100,000
pounds weight of sugar, and sending a number of them to
the island of Tobago. This event took place in February,
caught of twelve or fourteen inches in length. Its fins also are yellowish, and have a slight blush of red, mixed with that colour. Its scales are large and broad, and thick, and are more firmly joined to the flesh. It has also three or four straight yellow lines, running parallel with one another down its sides. It is caught in the Mediterranean, and in the British seas, especially on the coast of Cornwall, and is everywhere esteemed a very delicate fish. Ray.

Mr. Pennant calls this species of mullet the striped mullet, but he expresses a doubt whether this is not a variety, as Gronovius apprehends, of the red mullet, or *mullus barbatus*. This last, he observes, was highly esteemed by the Romans, and bore a very high price. They presented it alive to their guests in a glass vessel, that they might observe the beautiful changes of its evanescent colours during its expiration. Plin. i. ix. c. 77. See Hor. Sat. lib. ii. sect. 2. 33. and Juvenal, sat. iv. See *Mullus*.

**Surname**, or **Sirename**, a name added to the proper or baptismal name, to denominate the person of such a family. They were the Roman surnames first introduced the use of hereditary names, and that on occasion of their league with the Sabines; for the confirmation of which it was agreed, that the Romans should prefix Sabine names, and the Sabines, Roman names, to their own.

These new names became family names, or surnames, and the old ones continued personal names. The former they called cognominis, and gentilitia nominis; and the latter *praenomina*. See *Name*.

When the former came to be used among the French and English, they were called surnames, or surnames, not because they are the names of the fire, or father; but, according to Camden, because they are superadded to the personal name; or, rather, with Du-Cange, because at first this family name was written over (*Sur*) the other name, thus:

de Bourbon
Louis.

In lieu of surnames, the Hebrews, to keep up the memory of their tribes, use the name of their father, with the addition of Ben, son; as Melchi Ben Addi, Addi Ben Copham, &c.; or the Greek Iacou ou Diodala; Icarus, the son of Diodalus; Diodalus, the son of Eupomus, &c.

* So also the ancient Saxons, Ceoer, Ceodweland, Ceolwald Cuthing; that is, Ceonred, son of Ceolwald, son of Cuth; and in the same fene, the Welsh use ap for bap, son; as ap Owen, Owen ap Harry, Harry ap Rhyi; and the Irish, Mac, as Donald Mac Neul, Neil Mac Gen, &c.; and the old Normans, Fitz, as John Fitz Robert, Robert Fitz Ralph, &c.

Scaliger adds, that the Arabs used their fathers' name or surname, without their personal name; as, Acew-Pace, Acew-Zoir, &c. q. d. son of Pace, son of Zoir, &c. As, if Pace had a son at his circumcision called Hal, he would be called Acew-Pace, concealing Hal; but his son, however he were named, would be called Acew-Hal, &c.

The Romans, in time, multiplied their surnames: besides the general name of the race, or family, called gentilium, they took a particular one, to distinguish the branch of the family, called also cognomen; and sometimes a third, on account of some personal distinction; as that of Africannus, by Scipio; of Torquatus, by Manlius.

These three different kinds of surnames had also their different names, *viz.* *nomen*, cognomen, and apynomina; but these last were not hereditary; being, in effect, a kind of fibriquets, or nick-names, if that word be indifferent with respect to good and evil. See the subject of the Roman names and surnames accurately treated of by Spahheim, De Praef. and Usu Numinum. Diff. 10.

In thee, too, they have been imitated by later times; thus, in our English History, we find that Edgar was called the Peaceable; Ethelred the Unready; Edmund, Ironside; Harold, Harfoot; William, the Bajhard; Henry I. Beauclerk; John, Lackland, &c.—But as these names were never borne by the sons, Camden, and others, think it strange, that Plantagenet should be accounted the surname of the royal family of England; till Henry VII.; or Tudor, or Tudour, that from Henry VII. to king James I.; or that of Stewart, or Stuart, from king James I. to king George I.; or that Yale should be esteemed the surname of the late family of French kings; or Bourbon of the present; or Oldenburg of the kings of Denmark; or Hayburg of the emperors.

Du Chêfife observes, that surnames were unknown in France before the year 957, when the lords began to assume the names of their demesnes.—Camden relates, that they were first taken up in England, a little before the Conquest, under king Edward the Confessor; but he adds, they were never fully established among the common people, till the time of Edward II.; till then they varied with the father's name: if the father, e. g. was called Richard, or Roger, the son was called Richardson, or Rogerion: but from that time they were settled, some say, by act of parliament.

The oldest surnames are tho' we find in Domesday Book, most of them taken from places, with the addition of *de*; as Godfredus de Manneville, Walerus de Vernon, Robert de Oly, &c. Others from their fathers, with filius, as Guilelmus filius Obberi; others from their offices, as Eudo Dapifer, Guilelmus Cameraurio, Gilebertus Cocus, &c. But the inferior people are noted, simply, by their Christian names; without any surname at all.

In Sweden, till the year 1514, nobody ever took surnames; and the common people have none to this day, nor have even the native Irlins, Poles, and Bohemians, &c.—It is very late that the Welsh have any; and tho' they have are generally only formed by leaving out the *a* in *ap*, and annexing the *p* to their father's name; as in lieu of Evan ap Rice, they now say Evan Price, for ap Howell, Powell, &c. Du Tillet maintains, that all surnames were originally given by way of sobriquets, or nick-names; and adds, that they are all significant and intelligible to those who understand the ancient dialects of the several countries. The greatest part of our surnames, and those of the greatest account, Camden shews, are local, and borrowed from the places in Normandy, &c. where the respective persons who came over with the Conqueror, and first bore them, had their poffessions, or their births: such as Mortimer, Warren, Albigny, Piercy, Deroure, Tankerwil, Neill, Tracy, Montfort, &c. He adds that there is not a village in Normandy but gives name to some family in England.—Others were taken from places in England, as Afton, Sutton, Wotton, &c.

The Saxon common people generally took their father's or their mother's Christian name, with the addition of *en*; though many were surnamed from their trade, as Smith, Carpenter, Taylor, Weaver, Fuller, &c.; others from their offices, as Porter, Shepherd, Carter, Cook, Butler, &c.; others from their complexion, as Fairfas, i. e. fair hair; Blunt or Blond, i. e. flaxen or yellow; others from birds, as Wren, Finch, &c.; others from beasts, as Lamb, Hare, Hart, &c.; others from the winds; others from sains, &c.

**SURO**, in *Ichthyology*, a name given by some to a fish of 4F 2 the
the culcus kind, much resembling the mackarel in taffe and in shape, and more usually known by the name of the tarchuwan.

Suroorpourn, in Geography, a town of Hindoostan, in Oude; 40 miles S.E. of Fyzabad.

Surow, a town of Hindoostan, in Oirma; 20 miles S.E. of Balfoore.

Surowna, a town of Bengal; 23 miles S. of Ghidore.

Surey, or Sorox, an island in the North sea, on the coast of Norway; 44 miles long, and 8 broad. N. lat. 70° 34'; E. long. 22° 14'.

Surplice, the habit of the officiating clergy in the church of England. By Can. 58, every minister laying the public prayers, or administering the sacrament or other rites of the church, shall wear a decent and comely surplice with sleeves, to be provided at the charge of the parish. But by 1 Eliz. c. 2. and 13 & 14 Car. II., the garb prescribed by act of parliament, in the second year of king Edward VI., is enjoined; and this requires that in the saying or singing of matins and even-song, baptizing and burying, the minister in parish churches and chapels shall use a surplice. And in all cathedral churches and colleges, the archdeacon, dean, prebendaries, and fellows, being graduates, may use in the choir, besides their surplices, such hoods as may be proper to their several degrees. But in all other places, every minister shall be at liberty to use any surplice or not. And hence in marrying, churching of women, and other offices, not specified in this rubric, and even in the administration of the holy communion, it seems that the surplice is not necessary. Indeed, for the holy communion, the rubric appoints a white ALB plain, which differs from the surplice in being close-deeved, with a veemment or cope.

Surplusage, in Common Law, signifies a superfluity or addition of more than is needful; which sometimes is the cause of a writ abateth. But in pleading it is frequently set aside; the rest remaining good.

Surplusage is sometimes also applied to matters of accounts, and denotes a greater disbursements than the charge of the accountant amounteth to.

Surplusage of Intestate's Effects. See Intestate's Surplusage.

Surprise, To, in War, is to fall on an enemy unexpectedly, in marching through narrow and difficult passes, as in the passage of rivers, woods, inclosures, &c. There are various ways of surprising an enemy or place. See STRATEGEM.

Surebutter, in Law, is second rebutter; or the replication of the plaintiff to the defendant's rebutter.

Surrectorium, the name of a surgical instrument, mentioned by Ambrose Paré, and intended to keep the arm in an erect situation when required.

Surrejoinder, is a second defence of the plaintiff's declaration; by way of answer to the defendant's rejoinder.

Surrender, in Common Law, a deed or instrument, testifying that the particular tenant of lands and tenements for life, or years, doth sufficiently consent and agree, that he who has the next or immediate remainder or reversion of them, shall have the present estate of the same in possession; and that he hereby yields and gives up the same to him, so that the estate for life or years may be conveyed by mutual agreement of the parties. Of surrenders, there are three kinds; a surrender properly taken at common law, a surrender of copyhold or customary estates, and a surrender improperly taken, as of a deed, a patent, &c. The first is the usual surrender, and it is usually divided into that in deed, and that in law. Surrender in deed, is that which is really made by express words in writing, where the words of the lessor to the lessee prove a sufficient act to surrender his estate back again. But a surrender in law, is that wrought by operation of the law, and which is not actual. A man may have a lease of a farm for life, or years; and during the term he accepts a new lease; this act is, in law, a surrender of the former.

Surrender of a Bankrupt. See Petition of Bankruptcy.

Surrender of Copyholds, is the yielding up the estate by the tenant into the hands of the lord, for such purpose are expressed in the surrender; as to the use and behoof of A. and his heirs, to the use of his own will, and the like. This method of conveyance is so essential to the nature of a copyhold estate, that it cannot possibly be transferred by any other assurance. No feeoffment, fine, or recovery, (in the king's courts) hath any operation upon it. If I would exchange a copyhold with another, I cannot do it by a ordinary deed of exchange at the common law, but we must surrender to each other's use, and the lord will admit us accordingly. If I would devise a copyhold, I must surrender it to the use of my last will and testament; and in my will I must declare my intentions, and name a devisee, who will then be entitled to admission. Blackstone's Com. vol. i.

Surrender of Letters Patent and Oath. A surrender may be made of letters patent to the king, so that he may grant the estate to whom he pleases, &c.; and a second patent for years to the same person, for the same thing, is a surrender in law of the first patent. (10 Rep. 66.) If an officer for life accepts another grant of the same office, it is in law a surrender of the first grant; but if such an officer takes another grant of the same office to himself or another, it may be otherwise.

Surrender, in War, is to lay down one's arms, and yield yourself prisoner.

To surrender a place, see CAPITULATION.

Surreptitious. See Surreptitious.

Surrey, in Geography, one of the inland counties of England, is situated in the southern part of the kingdom, and is bounded by Sussex on the south, by Kent on the east, by Berkshire and Hampshire on the west, and by the north separated from Middlesex and a small part of Buckinghamshire by the river Thames. Surrey ranks below most of the other counties of England in extent; in greatest width from north to south about 15 miles, and its utmost length from east to west about 38. The best modern authorities compute its contents at 811 square miles, or 519,000 acres.

Historical Events.—The earliest inhabitants of this county were the Segontiacei, originally a people of Belgic, who settled at first in the western part of Hampshire, whence they were obliged to retire, on the arrival of another people of the same nation. After some time, however, each of them as had remained in Hampshire rejoined the main body, and thus they became confined within the tract which forms the present counties of Surrey and Sussex. According to the Roman division of England, the former county formed a part of the province of Britannia Prima. At the Saxon heptarchy, it constituted, with Sussex, a distinct state, under the title of Suth-Seaenna-ric; and on the division of England into five kingdoms, the present county of Surrey was called Suthrese, since modulated to Surrey. On the Danish invasion, and the Norman conquest, the landed property of this county, like most others, was divided and
SURREY.

given to the followers of the vicious monarchs. In later times, the history of Surrey is trivial. During the civil wars, it adhered closely to the parliament, and petitioned for the removal of the "evil counsellors" who were around the king. Surrey, as early as the time of the Saxons, conferred the title of earl; as Huda, the first who bore that distinction, was slain in battle with the Danes in 853.

General Aspect, Soil, and Climate.—The soil of this county is greatly varied, the different species lying intermixed in small patches. These, however, may be reduced to the general heads of clay, loam, and chalk. The most extensive and uniform tract of soil is that which occupies the whole southern border of the county, and forms what is denominated the Weald of Surrey; a district about thirty miles in length, and from three to five in breadth. This consists of a pale, cold, retentive clay, upon a subsoil of the same nature; its surface is flat, covered with wood, and its elevation is said to be less than any other vale district in the whole island. Proceeding northwards, the soil is chiefly loam, stretching across the whole county. Near Godalming, it runs to a great depth, and rests on a base of sandstone, veined with iron-ore. Contiguous to this commences the most remarkable district of the chalky downs, which lie nearly in the middle of the county; entering from Kent, into Surrey, by Croydon and Limpsfield, where their width is about seven miles: they, however, gradually decrease towards the west, till their termination near the border of Hampshire, where there is merely a narrow ridge, but little broader than the turnpike-road. Along the elevated summits of the downs, particularly about Walton and Hedley, and between the Mole and the Wey, is a large extent of heath, which, for a considerable depth, separates the chalk of the northern from that of the southern compartment of the downs. From the eastern extremity of the downs, running northward, is a variety of soils, consisting chiefly of brown clay and sandy loam, with patches of gravel, which continue almost to Dulwich, from which place to the extremity of the county, near Rotherhithe, is a brown unmixed clay. The climate of Surrey, as of other counties, where the soil is so varied, must likewise considerably vary. It is generally supposed that less rain falls in most parts of Surrey, than either in the metropolis, or in the vale of the Thames. From this circumstance the climate may, upon the whole, be regarded dry; but the southern border is damp, through the nature of the soil, and the flats of the surface. From these causes, the low parts near the Thames may be also considered as damp; but the atmosphere of the chalk hills, which crow the county from east to west, is dry, keen, and bracing. On the wide and exposed heaths, near Bagshot, Alderholt, and Hindhead, a similar climate also prevails.

Mineralogy.—Iron-ore is found in considerable quantities in the south-west part of the county, about Haselmer, Dunsfold, and Cranley; and in the south-east quarter, about Lingfield and Horne; but in consequence of the high price of fuel, the iron works of Surrey have been totally neglected. Fuller's-earth is discovered both to the north and the south of the downs, but the former is of inferior quality to the latter. This mineral has been dug for a great length of time in Surrey, as the oldest pit now wrought is said to have lasted for 50 or 60 years. Extensive quarries of stone, of a peculiar quality, are worked near Godstone, and its vicinity. When first taken from the quarry, it is incapable of bearing a damp atmosphere; but after being kept covered for a few months, it becomes sufficiently firm to reful the heat of a common fire, and is hence called fire-flone. In consequence of this property, it is much in demand for fire-places in the metropolis, and its neighbourhood. These flones are procured in various sizes, from 10 inches thick to 72 superficial feet. Chalk, brick-earth, sand, and coal, are likewise found in this county. The sand is in great request for hour-glasses; and the brick-earth produces those articles denominated fire-bricks, from their property of retarding heat. Camden and Evelyn notice jet-pits in Surrey, but no traces of them can be now discovered.

Rivers.—The principal rivers of this county are the Wey, the Mole, and the Wandle; whilst the Thames also washes its northern border. The former streams, after watering the county in different directions, finally discharge themselves into the Thames. A considerable branch of the Medway rives in the parishes of Godstone and Horne, and, passing through the parishes of Lingfield, quits Surrey, and enters Kent. The river Loddon skirts Surrey on its west side: its waters are used for the supply of the Basingstoke canal. In the western and south-eastern parts of the county are several ponds, some of which are preferred as fishponds, to keep fish to supply the London market. The mineral waters of Surrey were at one period in very high repute, but are now wholly neglected. This county is in general well furnished with springs; but for wells it is sometimes found necessary to perforate to the depth of 300 feet.

Tenure, Estates, &c.—The tenures are principally freehold, and the estates in Surrey are by no means extensive. The yeomanry are not so numerous as in the neighbouring county of Kent; though in the western division of the Weald, there are several gentlemen who farm their own estates, at from 200l. to 400l. per annum.

Leases, Size of Farms, Rents, &c.—The size of farms in Surrey may be considered rather small, the most extensive of which does not exceed 1600 acres: there are a few others from 600 to 1200, but the most common size is from 200 to 300; there are some, however, below that standard, and the average of the county is computed at 170. Most of the farms are leased for twenty-one years, though some for twenty-five, or thirty. A few are let for three lives; but there are many extensive farms held without a lease, from year to year. The rents, excepting in that part of the county which lies within the influence of the London market, may be deemed low. In the clays of the Weald many farms are let for ten, and there are few that amount to twenty shillings per acre. The rich sandy loams produce from twenty-five to thirty shillings per acre. But towards the vicinity of London, the rents rise in a considerable degree: at the distance of seven or eight miles, they run from two to three pounds; and within that distance, the ground lets for six, eight, and even ten pounds per acre.

Agriculture.—Surrey may be considered as inferior to many other districts of Great Britain, as it respects agricultural improvement. The drill method is chiefly practiced in the west of Surrey, near Bagshot, Elmer, &c. The produce of wheat is from two to five, and sometimes six quarters in an acre; and that of barley, from five to seven and a half. The latter is used only for malting, for which purpose it is considered equal to any in the kingdom. The climate and soil of Surrey seem to be less favourable to oats, than to wheat or barley. As the first is often grown on foul land, the produce is sometimes very low, not exceeding three quarters per acre; but when sown on clean lay, or after turnips, it frequently yields from six to eight quarters. Garden peas and beans are cultivated near the
the metropolis, and on the sandy loams about Mortlake, near the Thames; while the field varieties of both are extensively grown in most other parts of the county, and on the chalk-hills. Turnips are here raised in large crops: they are always sown, as strong objections prevail against drilling. When sown to be drawn off the field, from ten to twelve guineas are commonly given by cow-feeders; but when packed for market, they may be reckoned worth 40/- per acre.

The crops which are only partially cultivated in Surrey, are those of cabbages, potatoes, lucern, and grass, of which latter it has a much smaller proportion than most other counties in England. Carrots, clover, tainfoul, and hops, are extensively cultivated; and a greater quantity of land is employed in raising physical herbs, than in any other shire in Britain. Those which are chiefly reared, are peppermint, lavender, camomile, anised, liquorice, and poppy. Upwards of 350 acres of land in Surrey, are thus given to medicinal purposes. The whole quantity of garden ground employed for the London market in this county, amounts to about 3500 acres. Surrey is not celebrated for any particular kind of cattle; the Hereford, or short-horned breed of cows, is preferred; of which there are kept about 600, for the supply of London with milk. Rearing of calves for the market of the metropolis was once a common employment in this county, but this system is now diused. The cattle chiefly bred in Surrey are sheep, oxen, and hogs; many geese are also kept on the commons, and in the Weald. Within the last five or six years, large tracts of the heath- lands have been enclosed and cultivated; and it must gratify the philanthropist to see thousands of acres of ground, heretofore not only profitless, but almost a nuisance, rendered profitable to the proprietor, and useful to man.

**Forests, Woods, and Plantations.**—Under the Norman race of kings, a large portion of this county was reserved as part of the demesne of the crown, and preferred for the purpose of the chase. Under Henry II. the limits of Windlor forest were gradually extended, by the enclofure of his manors in Surrey, till he had converted the greater part of the county to a forest. On the accession of his son Richard, great part of this undertaking was entirely destroyed; and in succeeding times has been so much reduced, that very little forest remains. The district of Surrey most remarkable for its timber is the Weald; and the most common kinds in the county are oak, beech, walnut, ash, elm, box, yew, fir, birch, and maple; in addition to which, lime and chestnut are found about gentlemen’s seats.

**Waste Lands.**—Before the recent enclosures, it was computed that nearly one-sixth of Surrey was in this unprofitable state: but within the last 15 or 20 years, about 12,000 acres have been enclosed. A vast quantity, however, still remains entirely useless; and of heaths, which might be planted with every prospect of successe, there are no less than 48,180 acres. The whole amount of waste lands in the county of Surrey is computed at 73,540 acres.

**Roads and Canals.**—The turnpike-roads here are not in general remarkable for their excellence, and their faults are ascribed to various causes. The cross-roads on the hills, and in some other parts of the county, may be considered good; but on the clay of the Weald, on the sands, and in the low tract near the Thames, they are very indifferent. The Surrey iron railway from Wandsworth to Croydon was first projected in 1802, and is the first instance of the formation of roads of this nature for general use. The breadth of the road which is occupied by the going and returning railways and a foot-path, is twenty-four feet, and the rife is one inch to every ten feet. A large basin, capable of holding more than thirty barges, has been made at Wandsworth, for the purpose of forming a communication between the Thames and the rail road. It has been supposed, that the first locks used in England, were those erected on the river Wey, in Surrey. This county contains three canals; entitled the Bagshot, which runs from that place to the Thames; the Surrey, which communicates with the Thames at Rotherhithe; and the Croydon, which commences there, enters the Surrey canal at Deptford. The expence of constructing this latter work was estimated at 64,100l.

**Civil and Ecclesiastical Divisions.**—Surrey is divided into thirteen hundreds; which together contain one county-town, fourteen boroughts and market-towns, and 140 parishes: all of them in the diocese of Winchester, with the exception of nine parishes, which are peculiarities of the see of Canterbury. According to the population report of 1811, the number of houses in the whole county was 55,684, and that of the inhabitants 325,851. Surrey is represented in parliament by fourteen members: two for the county, and two for each of the boroughs of Southwark, Guildford, Reigate, Haslemere, Bleckingly, and Gatton.

**Antiquities.**—The situation of this county being contiguous to the capital of the Roman settlements in Britain, it is by no means surprizing that numerous remains of Roman antiquities are to be found within its limits. St. George’s Fields, Southwark, where coins and pavements have been found at different periods, was the centre of several Roman ways. One of these was the Ermine-street, which ran nearly parallel with, and but a short distance easterly of, the present turnpike-road. It proceeded from Mickleham Down to Dorking, and passing along a ridge of hill to Farnham, left Surrey, and entered Hampshire. The Stane-street or Stone-street of Cæsar branched out from the Ermine-street at Dorking, and passing throught Oakley, continued onwards into Sussex. Remains of Roman encampments are to be seen on Holmbury-hill, the parifh of Oakley, about two miles to the west of the Stane-street; and on Bottle-hill, in the parifh of Wadingham, near another military way, which also bore the designation of Stane-street, and passed through the easterly part of the county. But the most extensive work of this nature is that of St. George’s hill, near Walton on the Thames. Here Cæsar seems to have encamped previous to his confing the Thames at Coway Stakes, so named from the entrance of the Britons to obstruct his passage over the river. At Walton on the Hill, also, great quantities of Roman bricks and other relics have been discovered within an enclofure of earth-work; and on Blackheath are the remains of a Roman temple, surrounded with embankments. Various other military antiquities exist in Surrey on Latchhill, War-Coppehill, and on a common in the parifh of Effingham. — Historv and Antiquities of the Countv of Surrey, by the late Rev. Owen Manning, and continued to the present time by William Bray, Esq.; 3 volumes, 1804—1814. General View of the Agriculture of the County of Surrey, by William Stevenson, 8vo. 1809. Beauties of England, vol. xiv. by F. Shoberl, 1813.

**SURREY.**—See SURREY.
SUE

190. to the bishop of the diocese, for the due execution of his office. See Marriage.

SURROGATION. See Surrogation.

SURROOL, in Geography, a town of Bengal; 35 miles S.S.E. of Nagore. N. lat. 23° 40'. E. long. 87° 46'.

SURROPOUR, a cecar of Bengal, bounded on the N. by Rpongour; on the E. by Rpongour and Goragot; on the S. by Goragot and Dinagore; and on the W. by Dinagepur; about 15 miles long, and 12 broad. The chief town appears to be Samaung.

SURROWNAH, a town of Hindoostan, in Allahabad; 12 miles S.E. of Jionpur.

SURROWRY, a town of Hindoostan, in Dowlatabad; 22 miles S. of Reapour.

SURRY, a county of America, in the Salisbury district of North Carolina; bounded E. by Stokes, and W. by Wilkes; containing 10,366 inhabitants, of whom 14,695 are slaves. The Moravian settlements of Wachovia are in this county. Near the river Yadkin is a forge, which manufactures bar-iron. The Ararat (see Mount Ararat) or Pilot mountain, about 16 miles N.W. of Salem, is a high mountain, discernible at 60 or 70 miles distance, rises from a broad base in an easy ascent, like a pyramid, near a mile high, where it is not more than an acre broad; and then a vast rock presents itself suddenly to view, appearing like a large castle with its battlements, and erecting its perpendicular altitude upwards of 300 feet, and terminating in a level plain. The summit commands a delightful prospect of the Apalachian mountains on the N., and on the S. extended level country; while the streams of the Yadkin and Dan, on the right and left hand, are discovered at several distant places, winding their way, through the fertile low grounds, towards the ocean.

SURRY, a county of Virginia, bounded N. by James river, which separates it from Charles-city county; E. by the Isle of Wight, and W. by Prince George's county. It contains 6867 inhabitants, of whom 3440 are slaves.

SURRY, a county of the island of Jamaica, containing seven parishes, two towns, and eight villages. The towns are Kingston and Port-Royal, which are repectively.

SURRY, a town of Hancock county, in the district of Maine, on the W. bank of Union river at its mouth; containing 360 inhabitants.—Alfo, a township of New Hampshire, Cheshire county, containing 564 inhabitants; lying E. of Walpole, and incorporated in 1769.

SURYA, a town of Hindoostan, in Oude; 33 miles S.W. of Lucknow.

SURSAH, a town of Hindoostan, in Oude; 30 miles N.N.W. of Kairabad.

SURSEE, a town of Switzerland, in the canton of Lucerne, on the lake of Sempach; 13 miles N.W. of Lucerne. N. lat. 47° 4'. E. long. 9° 55'.

SUREFF, a town of Africa, in the kingdom of Tunis, usually called "Sarufa;" 8 miles W. of El Medea.

SURESH, a town of Persia, in the province of Khorasan; 30 miles W. of Sebxvar.

SUREOII, a town of Russia, in the government of Archangel; 140 miles E.S.E. of Archangel.

SURET, or SUREST, in Arithmetic, the fifth power of a number, or the fourth multiplication of any number, considered as a root.

The number 2, for instance, considered as a root, and multiplied by itself, produces $4$, which is the square, or second power of 2; and 4 multiplied by 2, produces 8, the third power, or cube, or solid number of 2; 8, again, multiplied by 2, produces 16, the fourth power, or quadrato-quadratum, or 16 multiplied once more by 2, produces 32, the fifth power or surfealt, or surfealtid number of 2.

SURESOLID Problem, is that which cannot be resolved, but by curves of a higher kind than the conic sections.

Thus, $a. gr.$ to describe a regular endecagon, or figure of eleven sides in a circle, it is required to describe an icosane, triangle on a right line given, whose angles at the base shall be quintuplicate to that at the vertex; which may easily be done by the intersecion of a quadratix, or any other curve of the second kind, as they are by some called, but not by any lower curve.

SURSOOTY, in Geography, a fort of Hindoostan, on the borders of Cachemire, which commands the paffes on a river of the same name; 114 miles N.W. of Delhi. N. lat. 29° 15'. E. long. 75° 35'.—Allo, a river of Guzerat, which runs into the Indian sea, 40 miles S.W. of Junagur.

—Allo, a river of Hindoostan, which rives in the northern parts of the country of Delhi, and joins the Caggur, 103 miles N.W. of Delhi. This is one of the seven faceted rivers of the Hindoos.

SURSUDEE, a town of Hindoostan, in Bahar; 34 miles E.S.E. of Bahar.

SURSUR, a town of Hindoostan, in Bahar; 8 miles E.N.E. of Chuprah.

SUSWUTTY, a river of Hindoostan, which runs into the Puddar; 26 miles W. of Pattun.

SURTAINVILLE, a town of France, in the department of the Channel; 15 miles W. of Valognes.

SURUBDY, a town of Hindoostan, in Bahar; 21 miles N.N.E. of Durbangh.

SURUBDYPOUR, a town of Hindoostan, in Bahar; 20 miles W. of Durbangh. N. lat. 25° 1'. E. long. 85° 44'.

SURVEY, in Law, is the ascertaining not only of the boundaries and royalties of a manor, or estate in lands; but also of the tenure of the respective tenants, and the rent and value of the same. In this last sense it is taken for a court, because in the falling of an estate, confiding of manors, to a new lord, where there are tenants by lease and copyholders, a court of survey is generally held; and sometimes upon other occasions, to apprise the lord of his right and interest, &c.

SURVEYS of the Board of Agriculture, those reports which have been made of the state of the agriculture of different counties under the direction of that board, in which the facts and particular practices of the different districts are recorded and brought to notice. A great part of the whole of the kingdom, has now been surveyed in this way, and much useful information brought to the attention of the farmer. The model or plan on which the reprinted reports are formed and conducted is somewhat as below, one uniform model being adopted for the whole: and which, after fully considering the subject, was pitched upon, as that which would include in it all the particulars which it was necessary to notice in an agricultural survey.

The plan of these improved reports is comprised in seventeen different heads or chapters, each of which include all the particulars which relate to that particular head, in different sections.

The material heads are those of the geographical state and circumstances of the county or district; the state of property in it; the buildings; the mode of occupation; the arable implements; the modes of enclosing fence-gates, crops, and land, tillage and crops; the grazing, grass-lands, and management; the woods and plantations; the live-stock; the improvements; the warehouses; the obstacles to improvement; the rural economy; the political economy, as connected with or affecting agriculture; the obstacles to improvement, including
SUR

cluding general observations on agricultural legislation and police; miscellaneous observations; and the conclusion, including the means of improvement, and the measures calculated for that purpose.

Under these different heads, all the various facts, practices, and processes, relating to, or connected with the business of husbandry, are comprehended and mostly explained in a full, distinct, and pretty clear manner.

Survey, in Sea Language, denotes an examination made by several naval officers, into the state of the provision or stores belonging to a ship, or fleet of men of war.

SURVEYING, in a general sense, denotes the art of measuring the angular and linear distances of objects, whereby to delineate their several positions on paper, and to ascertain the superficial area or space between them. This is of two kinds, land surveying and marine surveying; the former having generally in view the measure or contents of certain tracts of land, and the latter the position of remarkable objects, as beacons, towers, shoals, coasts, &c. Those extensive operations which have for their object the determination of the latitude and longitude of places, and the length of terrestrial arcs in different latitudes, are also placed under the general term surveying, though they are frequently distinguished by the designation trigonometrical surveys, or geodetic operations, and the science itself by geodesy.

Of Land Surveying.—This consists of three distinct cases: 1. The measuring of the several lines and angles. 2. Protracting or laying the fame down on paper, so as to form a correct map or representation of the estate or country. 3. The computation of the superficial content, as found by the preceding operation.

Various instruments are made use of for the purpose of taking the dimensions, the principal and most indispensible of which is the chain, commonly called Gunter's chain, which is 22 yards long, and is divided into 100 links, each link being .39 yard, or 7.92 inches: 10 of these square chains, or 100,000 square links, is one acre; that is 625 square links is 1 perch.

35,000 square links are 40 perches, or 1 rood.
100,000 square links are 160 perches, or 4 roods = 1 acre.

This is used for taking the linear dimensions, when the area of the land is required; but when only the positions of objects are to be laid down, a chain of 50 or 100 feet is more commonly employed instead of it.

Befide the chain, the surveyor must provide himself with ten small iron pins or arrows, about a foot long, for marking the several chain-lengths; these being successively put down by the person leading the chain, and taken up by him who follows, and whose business it is to direct the survey. He should also be furnished with several long object-flares, with small flags, for setting up at the several angles, &c. and a rod, divided into links, for measuring the offsets and bearings in the hedges or boundaries of the fields. These are sufficient for measuring an estate of considerable extent, but it frequently happens a deal of labour to be furnished with proper instruments for measuring of angles; the most usual and the best adapted for this purpose, are the circumferentor, theodolite, and semicircle, for a description of which see the former articles. The surveyor's crofs, or crofs staff, is likewise very convenient for ruling perpendiculars. See Cross-Staff.

The methods of measuring or surveying single fields with the Chain, Cross, Plain Table, &c. will be found explained under those articles: we shall therefore in the present instance merely offer a few observations with regard to the nature of larger operations, in which a manor, a lordship, or a county, is to be surveyed and transferred to paper, but without treating it according to the precise and strict rules employed in what is termed trigonometrical surveying, this having been already explained under the article Delineas.

Referring to Plate VII. we shall note, C, D, E, F, G, H, &c. represent any remarkable objects in a county, as towers, fleeples, mills, &c. the respective positions of which are to be determined.

First, an elevated situation is to be chosen, as a tower, a fleeple, &c. from which the greater number of those objects can be seen; after which, it will be necessary to rejoin to all the places where we can obtain a general knowledge of them, in order to make a rough sketch, which will afterwards serve to indicate the measures to be taken in the course of the operations.

The names of the objects should also be written upon this sketch, and notes be made of all the most remarkable particulars, by which they may be afterwards distinguished from each other, as by this means many mistakes, which might otherwise arise in this respect, will be avoided. In short, for the sake of greater certainty, it is proper to define the distances nearly at which we judge them to be, that they may not be confounded with other objects which may have little or no resemblance to them, or be situated in the same directions.

This being done, a base A B, chosen on a convenient spot, and as much as possible in a central position with respect to the several objects, is to be carefully measured. The instrument with which it is proposed to take angles (a theodolite for example) is then to be taken to the extremity A, of that base, and so disposed, that its centre will exactly correspond with the point A, and the fixed index be directed along the line A B, to a signal placed at the point B: the base should also be taken to render the instrument perfectly horizontal, according to the indications of the spirit-level which are attached to it. The fixed index still remaining in the direction A B, the moveable one is to be pointed successively to all the objects that are conveniently situated, and that can be seen from the point A, as C, D, E, F, G, H, in order to measure the angles B A E, B A D, B A C, B A H, B A G, and B A F, which the visual rays directed from the point A upon each of these objects, makes with the base A B; and after each observation, the measure of the angle should be written in a register, which ought to be headed with the name of the place where it is taken; and the objects to which the moveable index is directed should also be entered in the same register.

The observations to be made at the extremity A being completed, the theodolite is to be placed at the other end of the base B, in the same manner as at A, and the angles A B C, A B D, A B E, A B F, A B G, A B H, made by the visual rays directed from this station to the objects C, D, E, &c. to be measured; the distances of their objects from the points A and B are then to be found by calculation from the triangles which they form on the base A B, in each of which there are obviously given one side and the two adjacent angles.

With regard to the objects K and L, (which we have proposed could not be observed from the extremities A and B) it will be necessary to remove to the points C and D, which have already been determined, and from which those two objects can be conveniently seen. Then, considering C D as the base, the angles L C D, K C D, L D C, K D C, which the visual rays drawn from the extremities C and D to the objects L, K, make with it, are to be measured, and the triangles C L D and C K D are then to be computed; but as the angles only are known, it will first be requisite to compute the side C D, which is readily done by means of the triangle A C D, in which we know the angle C A D, its
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difference between the two angles \( \angle C A B, \angle D A B \), and the
fides \( \angle A C \) and \( \angle A D \), which are given by the preceding
calculation.

Let I be another objeçt, which has not been taken either
from the extremities of the base \( A B \), or from those of
CD. Here it is obvious that the side \( \angle C L \) of the triangle
\( \triangle C L D \), the length of which has been previously determined,
may be taken for a base; and after having observed the two
angles \( \angle C L I, \angle I L C \), the other parts of the triangle may be
readily found, from having one side and the two adjacent
angles given.

It is by such proceedings as the above, that those points
in a map which appear doubtful are verified and new ones
introduced.

The secondary triangles are also formed in the same man-
ner, for if we suppose that the point \( m \), within the prin-
cipal triangle \( \triangle C L D \), is to be taken, it is evident, that by ob-
serving from \( C \) and \( D \), the angles \( \angle C D \) and \( \angle D C \), we
shall have the triangle \( \triangle C m D \), in which the side \( C D \)
is known and the two oberved angles.

This example has been limited to a small number of ob-
jects, in order to simplify both the explanation and figure,
as without this contraction of the design, they would both have
been necessarily embarrassed and confused. What has been
said, however, will doubtless be sufficient to show the man-
ner in which a survey may be extended at pleasure by means
of a series of triangles commencing at a measured base, and
conveniently carried on according to the position of the ob-
jects to be taken and the localities of the situation. We
shall therefore only add, that in extensive surveys which
require great accuracy, the most certain way is to measure from
one base to another by different series of triangles leading to
the same two objects, and then to take the mean of the
results.

It will be important to make a few practical observations
in this place, which may not otherwise occur to the prati-
cioner, till dear-bought experience has pointed them out by
repeated inaccuracies and failures.

1. In the first place, then, it may be observed, that in
theoretical computations, if two angles of a triangle be
given, the third becomes known; but the surveyor must
never be satisfied with getting his third angle in this manner,
if there be any possibility of obtaining it from observation.

2. When it is absolutely necessary to measure a very acute
angle, it will require uncommon care; and, after all, the
result must still be considered as doubtful. It is likewise
essential in the calculation of distances, any
angle which is very acute or very obtuse.

3. At the same time that the angles, formed by the objects
which have not yet been surveyed, are measured, we should
avail ourselves of all suitable stations, in order to connect
with new triangles points already determined, particularly
if they be considered as doubtful; and by resolving these
triangles, it will be seen whether the calculations align the
fame situations to those points as they were previously made
to occupy.

For example, suppose the point I had been determined
by means of the triangle \( \triangle C L I \), and that, on account of
the situation of this point being considered as doubtful, we
wish to verify it from the station \( D \), where we are placed
in the course of the observations; if the two points I and
\( \angle D \) be conceived to be joined by the line \( \angle I D \), and the angle
\( \angle C I D \) to be measured, we shall have the triangle \( \triangle C I D \), in
which, besides this angle, there will be known the side \( CD \),
as previously determined, and the angle \( \angle C I D \), equal to the
two angles \( \angle L C D \) and \( \angle I C L \), which have also been ob-
erved. The triangle \( \triangle C I D \) may, therefore, be resolved;

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frequently used for this purpose, which give the reduced length of the Duping line from observation; but where great accuracy is required, the above is by far the most to be depended upon.

**PROB. II.**

Suppose it were determined to require the triangle \( A B C \) (Fig. 8.), the side \( A B \) and the angle \( A B C \) only being given; and that a wood, or some other obstacle, situated in the direction \( AC \), does not allow of any other angle being observed: suppose also, that on account of a pond, or morass, or the like, the length of \( BC \) cannot be accurately measured.

In this case, measure on the side \( BC \), or on that side produced, the greatest length possible, \( CD \), so that the object \( A \) may be seen from the point \( D \); then if the angle \( ABD \) be observed at \( B \), and the angle \( ADB \) at \( D \), one side and two angles will be known in the triangle \( ADB \); and, therefore, \( BD \) may be computed; and, consequently, if \( CD \) be added to it, or subtracted from it, according as this length was measured on the side \( BC \), or on its prolongation, the side \( BC \) will be obtained; but by hypothesis, the angle \( ABC \) is also known; and the triangle \( ABC \) may, therefore, be resolved by the common principles of trigonometry.

Again, let us suppose the length \( CD \) cannot be measured, either upon the side \( BC \), or on its prolongation, or that \( BC \) cannot be sufficiently extended in that direction, to allow the point \( A \) to be seen.

In this case, a right line \( CE \) is to be measured in any direction, either to the right or left of the point \( C \); then if there be observed at \( B \) the angles \( CBA \), \( EBA \), and at \( E \) the angles \( AEB \), \( AEC \), etc., the angles, and the side \( AB \), which is known, will furnish sufficient data for computing the lines \( BE \), \( BC \), and then revolving the triangle \( ABC \) in the manner above stated: thus the line \( BC \) will be connected with the preceding triangles, and may be used as a base in the series of operations.

**PROB. III.**

Let \( AB \) (Fig. 9.) be any known distance, at the extremity of which the necessary observations cannot be made for determining the right line \( CD \), from which it is required to form a series of triangles, connected with those by which \( AB \) was found. Suppose also, that it is impossible to measure \( CD \), either wholly or in part, or even any other line, of which \( C \) or \( D \) is one of its extremities: in short, that nothing farther can be done than to observe the angles \( AEC \), \( BCD \), at the point \( C \); and the angles \( CDA \), \( ADB \), at the point \( D \).

Here, as the line \( CD \) cannot be measured, any length \( CD \) must be assumed for it; and whatever length may be, it will not change the values of the angles taken at the points \( C \) and \( D \). These angles remaining the same, the sides of the triangles, which result from the assumed length \( CD \), will be proportional to the homologous sides of those which the true length of that line would give, since the former triangles are similar to the latter.

This being premised, if the angles \( AEC \), \( BCD \), be observed at the point \( C \), and the angles \( CDA \), \( ADB \), at the point \( D \), two angles and the side \( CD \), the assumed length of \( CD \), will be known in the triangle \( AC \), which is similar to the triangle \( ACD \); therefore, the sides \( CE \) and \( AD \) may be computed; and as two angles and the side \( CD \) are also known in the triangle \( BCD \), the sides \( CB \) and \( DB \) may likewise be computed. And, lastly, in the triangle \( ADB \), the two sides \( DA \) and \( DB \), and the contained angle \( aDB \), are known, from which \( AB \) will be found; and we shall then have the true distances by means of the following proportions, viz.

\[
\begin{align*}
\frac{cD}{aC} & = \frac{aD}{A D} \\
\frac{bC}{bD} & = \frac{bD}{B D}
\end{align*}
\]

the lines whose dimensions were required.

**PROB. IV.**

To find the position of a place from which three points, previously determined, can be seen, but such that from these points the place cannot be perceived.

Let \( A, B, C \) (Fig. 10.) be the three points, the positions of which are given, so that all of the parts of the triangle \( A B C \) are known; and let \( D \) be the point to be determined. It is required to find the distances \( BD, AD, \) and \( CD \), by observing the angles \( m \) and \( n \).

Let \( x, y \), and \( z \), represent the angles \( BAD, \angle DBC, \) and \( BCD \), respectively; then in the triangles \( ABD, ABD, \) which have the side \( BD \) common, we have

\[
BD = \frac{AB \cdot \sin x}{\sin m} = \frac{BC \cdot \sin z}{\sin (m + n)}
\]

But \( x = 180^\circ - n = y = 180^\circ - n - (180^\circ - B - z) = x + B - n \); therefore, also,

\[
\sin x = \sin x \cdot \cos (B - n) + \cos x \cdot \sin (B - n)
\]

\[
= AB \cdot \sin (m + n) \times \sin x
\]

\[
= BC \cdot \sin m
\]

By dividing this last equation by the \( \sin x \), we obtain

\[
cot x = \frac{AB \cdot \sin (m + n)}{BC \cdot \sin m \cdot \sin (B - n)} - \cot (B - n)
\]

or, for the sake of greater convenience in the calculation,

\[
cot x = \cot (B - n) \left\{ \begin{array}{c}
\frac{\sin C \cdot \sin (m + n)}{\sin BAC \cdot \sin m \cdot \cos (B - n)} - 1
\end{array} \right\}
\]

from which equation the part \( x \), of the angle \( BAC \), and consequently the other part \( CAD \), will be known; and the resolution of the triangles \( ABD, ACD \), will give the distances required.

This solution possesses the advantage, that the equations from which it is obtained holds good in all cases, as appear from the following observations.

1. If we had \( B - n \), the cot. \( B - n \) would be negative, which is the only change in the equation.

2. If the point \( D \) be within the triangle \( ABC \), we shall have \( m + n \) greater than \( 180^\circ \); in which case, the \( \sin (m + n) \) will likewise be negative. Besides, although all of the angles \( A, B, C \), may be obtuse, yet the segment of one of the acute angles is to be sought, in order to avoid any embarrassment and uncertainty respecting the species of the angle \( x \); and we have always our choice of this respect.

3. If \( B \) were equal to \( zero \), which happens when the three points \( A, B, C \), are in a right line; the point \( B \) must then be supposed at \( y \), and the angle \( x \) changes into \( B + D ) \), and we should have

\[
cot x = \cot n \left\{ \frac{AB \cdot \sin (m + n)}{BC \cdot \sin m \cdot \cos n} \right\} - 1
\]

\[
cot x = \frac{AC \cdot \cot n - A \cdot B \cdot \cot m}{BC}
\]
4. When $B = a$, the problem is indeterminate, as in this case, cot. $(B - a)$ is infinite, and the point $D$ may have an infinite number of positions, each of which will satisfy the conditions of the question, as is evident from the following construction, which will in fact supercede in many cases the necessity of any computation; as for instance, when the absolute lengths of the lines $AB, BD$, and $CD$, are not required, but merely the position of the point $D$ on the map.

Construction.—If a circle be supposed to pass through the points $A, B, D$, we shall have $\frac{1}{2}AB = \text{fin. } m$. And as this line is proportional to the radius of the circle, it will be easy to find the radius, by dividing $\frac{1}{2}AB$ by fin. $m$, as taken from the tables.

In this manner, $\frac{AC}{\text{fin. } m}$ will be the radius of the circle, which would pass through the points $A, C, D$.

Therefore, if these two circles be described with their respective radii, such as found by the calculation, they will intersect each other in the point $D$, from which the position of that point will be determined.

**PROB. V.**

From the top of an eminence, the height of which is given, to determine the horizontal distance between two objects situated below.

Let $R$ (fig. 11.) be the elevated point, the height of which above the common horizontal plane of the objects $A, P$, is equal to $RE$; the distance $AP$ may be determined from $R$, in the following manner.

Take the angle $ARP$, and the angles of depression, or the complements of $PARE$ and $ARE$. Then, in order to reduce the angle $ARP$ to $APE$, we find in the triangles $APR, APE$, the common side $AP$, and

$$AP = AR^2 + PR^2 - 2AR \times PR \cdot \text{cot. } ARP$$

$$= AE^2 + PE^2 - 2AE \times PE \cdot \text{cot. } APE;$$

from which last equation, we obtain

$$\text{cot. } AEP = \frac{AR \times PR \cdot \text{cot. } ARP - RE}{AE \times PE}$$

and this gives

$$\text{cot. } AEP = \frac{\text{cot. } ARP - \text{fin. } RAE \cdot \text{fin. } RPE}{\text{cot. } RAE \cdot \text{cot. } RPE}$$

or, to simplify the computation,

$$\text{cot. } AEP = \tan \cdot \text{RAE} \cdot \frac{\text{cot. } ARP}{\text{tan. } PRE \cdot \left(\frac{\text{fin. } RAE \cdot \text{fin. } RPE}{\text{fin. } RAE \cdot \text{fin. } RPE - 1}\right)}$$

From the former of these, which is the easiest to enunciate, Cagnoni deduces the following rule for reducing an angle, having its vertex out of the plane of reduction: vis.

"The cofine of the reduced angle is equal to the cofine of the observed angle, minus the rectangle of the sides of the angles of elevation; the remainder being divided by the rectangle of the cofines of the same angles."

The angle $ARP$ being thus reduced to $APE$, the two others, with the side $RE$, will serve to calculate $AE$ and $PE$; and, consequently, the requisite data will thus be obtained for finding the distance $AP$.

**Note.**—Instead of the preceding formulas of reduction, that given by Delambre may be employed, which is more convenient for the purposes of computation: vis.

$$\text{fin. } \frac{1}{2}AEP = \sqrt{\left(\frac{\text{fin. } (ARP + \text{RAE} - \text{PRE})}{\text{fin. } (ARP + \text{PRE} - \text{RAE}) \times \text{cot. } RAE \times \text{cot. } RPE}\right)}$$

It may be observed, with regard to the practical utility of this problem, that, as it is easy to measure an altitude with great accuracy by the barometer, we may determine from a projecting part of a steep mountain, the positions of the towns and other objects situated in the valleys which it overlooks, without the necessity of measuring a base.

For further information on this subject, the reader is referred to the "Trigonometrical Survey of England and Wales," by Col. Mudge; "Base du Systeme Metrique Decimal," by Delambre; "Exposition des Operations faites en Lapponie," by Swanberg; and the treatises on "Topography and Geodézia," by Puissant; and to the "Mémoire Topographique," lately translated into English by M. Marlotte.

**SURVEYING Crofts.** See Cross.

**SURVEYING Quadrant.** See Quadrant.

**SURVEYING Scale.** The same with reducing scale.

**SURVEYING Wheel.** See Perambulator.

**SURVEYOR.** One that hath the oversight and care of considerable works, lands, or the like. See Supervisor.

**SURVEYOR of his Majesty's Woods and Parks.** An officer of the king's privy chamber, who is in the office of surveyor of the king's woods;

**SURVEYOR of the Crown lands, &c.**

**SURVEYOR of the Highways.** See Highway.

**SURVEYOR, Marine.** See Marine Surveyor.

**SURVEYOR of the Mells, &c.** An officer of the mint, whose business is to keep the bullion cast out; and that it be not altered after the delivery of it to the melter.

**SURVEYORS of the Navy, &c.** Two officers who are issuing to the naval board, being invested with the charge of building and repairing his majesty's ships at the several dock-yards of the kingdom, for which purpose they are trained to the theory and practice of ship-building. It is also their office to know the state of the navy; to audit the accounts of all boatmen and carpenters serving therein; and to enquire into the condition of all the naval stores, at home and abroad, in order to supply whatsoever may be deficient.

**SURVEYOR of the Ordnance, &c.** An officer, whose charge is to survey all the king's ordnance, store, and provisions of war in the custody of the storekeeper of the Tower of London; to allow all bills of debts, to keep checks on labourers' and artificers' works, &c.

There are also many other officers called surveyors, in the different departments in the state and revenue; as the surveyor of the pictures in the royal household; surveyor of the private roads, and surveyor of gardens and waters, belonging to the Board of Works, &c.; surveyor-general of the duchy of Cornwall; general surveyors, and surveyors of counties, belonging to the tax-office; surveyors of land and woods, belonging to the duchy court of Lancaster; surveyor-general, surveyor, surveyors-general, resident in London, and also of the riding officers; land-surveyors; surveyors of paper, keys, baggage, land-carriage officers, buildings, coal-warehouses, king's warehouse, East India warehouse and navigation, belonging to the customs; general surveyors; general surveyors of distillery; surveyors of glass and coaches, in the excise office; surveyors of the salt-office; resident surveyors of the general post-office, and bye-letter office; surveyors of the stamp duties; surveyors of the hawkers' and pedlars' office; surveyor of the royal hospital at Greenwich; surveyor of the victualling-office, &c.

**SURVEYOR is also used for a gauger.** And also for a person who measures and makes maps of lands. See Surveying and Gauging.
and superintends private and public buildings. See Building, and Party-Walls.

SURVIVOR, in Law, signifies the longer liver of two joint-tenants; or any two persons joined in the right of any thing.

Thus, when two or more persons are seised of a joint-estate of inheritance, for their own lives, or per stirres, or are jointly possessed of any chattel intereath, the entire tenancy upon the decease of any of them remains to the survivor, and at length to the last survivor; and he shall be entitled to the whole estate, whatever it be, whether an inheritance or a common freehold only, or even a less estate. This right of survivorship is called by our ancient authors the jus accrescenti
di, because the right upon the death of one joint-tenant, accumulates and increases to the survivor; or as they themselves express it, pars illa communis extricit superficibus, de personis in possessum usque ad ultimum super-

ditem. And this jus accrescenti ought to be mutual; which judge Blackstone apprehends to be the reason why neither the king, nor any corporation, can be a joint-tenant with a private person; for here is no mutuality; the private person has not even the remotest chance of being seised of the entirety, by benefit of survivorship; for the king and corporation can never die. For the encouragement of husbandry and trade, it is held, that a flock on a farm, though occupied jointly, and also a flock used in a joint undertaking, by way of partnership in the same, shall always be considered as common and not as joint property; and there shall be no survivorship therein. Blackst. Comm. b. ii.

SURVIVORSHIP. Payments which are not to be made till some future period, are termed reverstions, to distinguish them from payments which are to be made immediately.

Reverstions are either certain or contingent. Of the former sort are all sums or annuities payable certainly at the expiration of any terms, or the extinction of any lives. (See Rescusions.) Of the latter sort are those which depend on any contingency; as, particularly, the survivorship of any lives beyond other lives. These form the most intricate and difficult part of the doctrine of reverstions and life-annuities; and the books in which this subject is treated most at large, and at the same time with the most precision, are Mr. Simpson's Select Excerpts; Dr. Price on Reverstional Payments; and Mr. Morgan on Annuities and Assurance on Lives and Survivorships.

The whole likeness of the third volume of Mr. Dodfon's Mathematical Repository relates to this subject; but Mr. Dodfon's investigations being founded on M. De Moivre's hypothesis, of an equal decrement of life through all its ages, the rules are very incorrect, when the lives are either under 15, or exceed 60 years of age. For this reason, Dr. Price, and also Mr. Mares, curator baron of the exchequer, (in two volumes, entitled the "Principles of the Doctrine of Life-Annuities," have discarded the "Principle of the Doctrine of lives ground upon it; and the former, in particular, in order to set aside all occasion for using them, has sublittuated in their room a great variety of new tables of the probabilities and values of lives, at every age, and in every situation, calculated not upon any hypothesis, but in such conformity to the best observations. These tables, added to other new tables of the same kind in Mr. Baron Mares's work just mentioned, form a complete set of tables, by which all questions relating to annuities on lives and survivorships, may be answered with as much correctness as the nature of the subject allows. See Life-Annuitas.

It should be observed, that in all computations of contingent reversions involving together the lives of males and females, the shorter duration of the former is a circumstance which ought not to be disregarded. The following tables therefore, derived by Dr. Price from the probabilities of lives in Sweden among males and females separately, are inserted here, not only as being well fitted for calculating the values of reverstions of the above-mentioned description, but also as they serve to prove the truth of an important fact, not previously ascertained, in the doctrine of life-annuities.

**Table I.**

Shewing the probabilities of the duration of human life among males and females, deducted from observations of the proportions of the living to the numbers that have died at all ages for twenty-one years, from 1775 to 1796, in the kingdom of Sweden.

<table>
<thead>
<tr>
<th>Age</th>
<th>Males: Birth 10,282—283 born dead</th>
<th>Females: Birth 10,277—317 born dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Born alive.</td>
<td>10,000</td>
<td>2300</td>
</tr>
<tr>
<td>1 year</td>
<td>7,700</td>
<td>500</td>
</tr>
<tr>
<td>2</td>
<td>7,222</td>
<td>337</td>
</tr>
<tr>
<td>3</td>
<td>6,853</td>
<td>440</td>
</tr>
<tr>
<td>4</td>
<td>6,624</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>6,473</td>
<td>125</td>
</tr>
<tr>
<td>6</td>
<td>6,348</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>6,243</td>
<td>90</td>
</tr>
<tr>
<td>8</td>
<td>6,153</td>
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<td>6,078</td>
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<td>11</td>
<td>5,958</td>
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<tr>
<td>12</td>
<td>5,917</td>
<td>35</td>
</tr>
<tr>
<td>13</td>
<td>5,868</td>
<td>30</td>
</tr>
<tr>
<td>14</td>
<td>5,828</td>
<td>40</td>
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<tr>
<td>15</td>
<td>5,788</td>
<td>39</td>
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<tr>
<td>16</td>
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<tr>
<td>17</td>
<td>5,710</td>
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<tr>
<td>18</td>
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</tr>
<tr>
<td>25</td>
<td>5,323</td>
<td>50</td>
</tr>
<tr>
<td>26</td>
<td>5,268</td>
<td>50</td>
</tr>
<tr>
<td>27</td>
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</tr>
<tr>
<td>28</td>
<td>5,158</td>
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</tr>
<tr>
<td>29</td>
<td>5,103</td>
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</tr>
<tr>
<td>30</td>
<td>5,049</td>
<td>50</td>
</tr>
<tr>
<td>31</td>
<td>4,988</td>
<td>60</td>
</tr>
<tr>
<td>32</td>
<td>4,928</td>
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<td>33</td>
<td>4,868</td>
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<td>38</td>
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<td>41</td>
<td>4,383</td>
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<tr>
<td>42</td>
<td>4,311</td>
<td>170</td>
</tr>
</tbody>
</table>

### Table III.

Shewing the values of annuities on single lives among males and females, according to the probabilities of the duration of life in the kingdom of Sweden. See Table I.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Males, 4 per Ct. 5 per Ct.</th>
<th>Females, 4 per Ct. 5 per Ct.</th>
<th>Lives in general, 4 per Ct. 5 per Ct.</th>
<th>Males, 4 per Ct. 5 per Ct.</th>
<th>Females, 4 per Ct. 5 per Ct.</th>
<th>Lives in general, 4 per Ct. 5 per Ct.</th>
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<td>15.571</td>
<td>18.139</td>
<td>15.425</td>
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<tr>
<td>4</td>
<td>18.328</td>
<td>16.624</td>
<td>18.782</td>
<td>15.956</td>
<td>18.554</td>
<td>15.787</td>
</tr>
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<td>18.503</td>
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<td>16.088</td>
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<td>18.105</td>
<td>15.684</td>
<td>18.508</td>
<td>15.906</td>
<td>18.336</td>
<td>15.793</td>
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<td>15.856</td>
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<td>15.685</td>
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<td>17.803</td>
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<td>18.290</td>
<td>15.761</td>
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<td>17.573</td>
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<td>17.307</td>
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</table>
Table IV.

Shewing the values of annuities on two joint lives, according to the probabilities (in Tab. II.) of the duration of human life among males and females collectively, reckoning interest at 4 per cent.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
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<td>1-7</td>
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<td>1-7</td>
<td>13.989</td>
<td>1-7</td>
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<tr>
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<td>3-9</td>
<td>13.919</td>
<td>3-9</td>
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<tr>
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<td>5-9</td>
<td>13.919</td>
<td>5-9</td>
<td>13.919</td>
<td>5-9</td>
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<td>45-9</td>
<td>13.919</td>
<td>45-9</td>
<td>13.919</td>
</tr>
</tbody>
</table>

Interest 4 per cent.

Differences of age 0, 6, 12, and 18 years.
The preceding tables furnish the means of determining the exact difference between the values of annuities, as they are made to depend on the furvivorship of any male or female lives; which hitherto has been a desideratum of considerable consequence in the doctrine of life-annuities. What has made this of consequence is chiefly the multitude of societies, established in this and foreign countries, for providing annuities for widows. The general rule for calculating from these tables the value of such annuities is the following.

**Rule.**—Find in Table III. the value of a female life at the age of the wife. From this value subtract the value in Table IV. of the joint continuance of two lives, at the ages of the husband and wife. The remainder will be the value in a single payment, payment of an annuity for the life of the husband, should he be left a widow. And this last value, divided by the value of the joint lives increased by unity, will be the value of the same annuity in annual payments during the joint lives, and to commence immediately.

### Table V.

<table>
<thead>
<tr>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
<th>Ages</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td></td>
<td>21-40</td>
<td></td>
<td>41-60</td>
<td></td>
<td>61-80</td>
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<td></td>
<td>121-140</td>
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<td>141-160</td>
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<td>161-180</td>
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<tr>
<td>21-40</td>
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<td>41-60</td>
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<td>61-80</td>
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**Example.**—Let the age of the wife be 24, and of the husband 30. The value in Table III. (reckoning interest at 4 per cent.) of a female life aged 24, is 17.257. The value in Table IV. of two joint lives aged 24 and 30, is 31.457, which, subtracted from 17.257, leaves 3.797, the value, in a single payment, of an annuity of $1. for the life of the wife after the husband; that is, for the life of the widow. The annuity, therefore, being supposed 20l., its value, in a single payment, is 20 multiplied by 3.797, that is 75.94. And this last value divided by 14.455. (that is, by the value of the joint lives increased by unity,) gives 5.25, the value in annual payments beginning immediately, and to be continued during the joint lives. If an annuity of 20l. to a wife aged 24, for her life, after her husband aged 30.

In order to give as full directions as possible in this important case, we shall here insert the following table, taken from the Treatise on Reversionary Payments, vol. i. p. 431. 7th edit.
**TABLE VI.**

Shewing the value of an annuity for the use of a wife after the death of her husband, deduced from the Sweden observations, on the separate probabilities of the duration of life among the males and females.

**Annuity 10l. Interest 4 per cent.**

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<td>58</td>
<td>96.25</td>
<td>78</td>
<td>93.63</td>
<td>5.81</td>
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</table>

and then multiply it again by the probability that the two given lives shall both continue the given term. This last product will be the answer in a single present payment. And this answer, divided by the value of the joint lives increased by unity, will be the answer in annual payments, to commence immediately, and to be continued during the joint lives.

**Example.**—The value is required of an annuity of 1l. for the life of a wife aged 20, after her husband aged 25; provided the husband lives four years. Interest at 4 per cent.

**Answer.**—The given lives increased by four years become 24 and 30. The value of an annuity for the life of a wife aged 24, after her husband aged 30, has been found to be 3.797, which discounted for four years, (that is, multiplied by .8548, the value of 1l. due at the end of four years, by Tab. II. under Annuities,) becomes 3.245. The probability that a female life, aged 20, shall continue four years, is (by Tab. I.) 3.245. The probability that a male life, aged 30, shall continue four years, is 3.245. The probability, therefore, that the two lives shall both continue four years, is 3.245, multiplied by 3.245, which, multiplied by 3.245, gives 1.357, the answer in a single payment. And 3.245, divided by 15.144, (the value increased by unity of two joint lives aged 20 and 25, by Tab. IV.) gives 190, the value in annual payments, to commence immediately, and to be continued during the joint lives of the husband and the wife. The annuity, therefore, being supposing 20l. (to be enjoyed for life by a wife aged 20, after her husband aged 25, provided he lives four years,) the value is, in a single present payment, 69.341; and, in annual payments, 5.994.

**Problems in the Doctrine of reversionary Sums and Annuities payable on Survivorships.**

**PROBLEM I.**

To find the value of an annuity payable for what shall happen to remain of a given life, after it has survived another given life.

**Solution.**—From the value of the life of the expeéntant subtract the value of the joint lives. The remainder will be the number of years' purchase which ought to be given for the annuity.

**Example.**—Let the expeéntant be a male aged 24, who is to enjoy 10l. per annum for his life, after a female aged 30. The value of his life, reckoning interest at 4 per cent., is (by Tab. III.) 16.742. The value of the joint lives is (by Tab. IV.) 13.458; which, subtracted from 16.742, leaves 3.287, the number of years' purchase to be given for the annuity; which being 30l., its value is 65.742, in a single payment. And 65.742, divided by 14.855, (that is, by the value of the joint lives increased by unity,) gives 4.47l., the value, in annual payments, to commence immediately, and to be continued during the joint lives.

**N.B.**—It has been before shown, that had the expeéntant been a female aged 24, and the survivor a male aged 30, the former value would have been 75.041, and the latter 5.251. Such is the difference in this case depending on the survivorship being that of a female rather than a male. In many other cases, the difference is much greater.

**PROBLEM II.**

To find the present value of an estate of a given yearly value, to be entered upon on the survivorship of a given life beyond another.

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Solution.—Find the value of an annuity on two equal joint lives, whose common age is equal to the age of the oldest of the two proposed lives, which value subtract from the perpetuity, and take half the remainder. Then say, as the expectation of the youngest of the two lives is to that of the oldest, so is the said half remainder to a fourth proportional, which will be the number of years' purchase required, when the life of the expectant is the oldest of the two. But if the expectant is the youngest, then add the value so found to that of the joint lives, and let the sum be subtracted from the perpetuity, and the answer will be obtained.

The value thus found, divided by the value of the joint lives, increased by unity, will give the value in annual payments, beginning immediately, and to be continued during the joint lives.

N.B. In this and all the following solutions, no distinction is made between the lives of males and females.

Example.—Suppose the ages of the two lives to be 30 and 34, the former of which is the expectant. Let the yearly value (or net rent) of the estate be 20l., and the rate of interest 4 per cent. The value of two equal joint lives, aged 30, is (by Tab. IV.) 12,965; the perpetuity is 25; the difference is 13,035; the half of which is 6,017; the expectation of the youngest life is (by Tab. II.) 35,29; and of the oldest life, 31,21. Therefore, as 35,29 is to 31,21, so is 6,017 to 5,324 years' purchase, which, multiplied by 20 (the rent of the estate), gives 106,48, the required value in a single payment of a reversionary estate to come to a person aged 30, provided he survives a person aged 24. And 106,48, divided by 14,455, (the value of the joint lives increased by unity,) quotes 7,36, the value required in annual payments during the joint lives.

Had the youngest life been the expectant, the value just found in years' purchase (that is, 5,324) must have been added to 13,455, the value (by Tab. IV.) of the joint lives, which would have made 18,779; and this sum subtracted from 25 (the perpetuity,) would have given 6,221, the value in years' purchase of the estate, supposing it to come to the younger of the two lives aged 24 and 30, provided it survives the oldest.

PROB. III.

To find the value in present money of a legacy, or any gross sum, payable to a person of a given age, on his surviving another person, whose age is also given.

Find by the last problem the value in years' purchase of an estate, whose net rent is the same with the interest of the given sum; and this value divided by 1/t, increased by its interest for a year, and the quotient multiplied by the interest of the given sum, will be its value in a single payment. And this single payment, divided by the value increased by unity of the joint lives, will be the value in annual payments, to commence immediately.

Example.—Suppose, as in the last example, the ages of the two lives to be 30 and 24, the former of which is expectant. Let the legacy be 500l., the interest of which at 4 per cent. is 20l. The value of an estate of 20l. per annum, to come to a person aged 30, if he survives a person aged 24, is, by the solution of the last problem, 5,324 years' purchase, which divided by 1,04, (that is, 1/t, increased by its interest at 4 per cent. for a year,) and multiplied by 20l., gives 102,2, the required value in a single payment of 500l. payable to a person aged 30, on his surviving a person aged 24. The value in annual payments, during the joint lives, is 7,011. The reason of the difference between the value of an estate, and a sum equivalent to it, may be seen in Dr. Price's Treatise on Reversionary Payments, vol. i. chap. 1. quod. 10.

This rule, first given by Mr. Simpson, in his Seu Exercitii, is partly founded on M. De Moivre's hypothesis, and, in the middle stages of life, gives the values sufficiently correct; but if either of the two lives be very old or very young, it is by no means to be depended upon. In these cases, the following rule, deduced from the real probabilities of life, and given by Mr. Morgan in the 78th volume of the Philosophical Transactions, should always be adopted. Let F denote the value of an annuity on a life one year younger, and P on a life one year older than B; A, A', A F, and A B, the values of an annuity on the joint lives of A and F, A and P, and A and B. Let a denote the number of persons living in the table at the age of F; b, the number at the age of B; c, the number at the age of P; and let r be 1/t, increased by its interest for one year, then will the exact value of the sum S, payable on the contingency of B the elder life surviving A the younger, be equal to

\[ \frac{S \times F - A F - c \times P - A P}{r} + r - 1 \times B = \frac{A F}{b} \]

The value of S, on the contingency of A the younger surviving B the elder, is obtained, as in Mr. Simpson's rule, by subtracting the value found above from the whole value of the reversion, after the extinction of the joint lives.

It may not be improper to observe, that M. De Moivre has given a very erroneous solution of this problem; and the reader, if he has any doubt, may be convinced of its inaccuracy, by referring to Dr. Price's Treatise on Reversionary Payments, vol. i. chap. 3. 7th edit.

PROB. IV.

To find the annuity payable during life to a person of a given age, if he survives another person whose age is given, and which is equivalent in present value to a given fixed legacy payable on the same contingency.

Solution.—Find the difference between the value of a single life of the expectant, and the value of the joint lives. Find also, by the last problem, the value of a single payment of the given sum or legacy. The latter, divided by the former, will give the required life-annuity.

Example.—Let the ages be 30 and 24, the former of which is expectant. Let the sum be 500l., and the rate of interest 4 per cent. The value of the life of the expectant (in the columns for lives in general, in Tab. III.) is 16,005; the value of the joint lives is (by Tab. IV.) 13,455; the difference is 2,551. The value, by the last problem, of 500l. payable, if a life aged 30, survives life aged 24, is 102,2; which, divided by 2,551, gives 40,06, the life-annuity, equivalent to the sum, reckoning interest at 4 per cent.

The single and annual premiums, in the following table, have been computed by Mr. Simpson's rule in the last problem, and the equivalent annuity by the rule in the fourth problem.
Survivorship.

Table VII.

Shewing the value of 100l. depending on the contingency of one life surviving another, according to the Northampton Table of Observations, (see Tab. III. under Life-Annuities,) reckoning interest at 3 per cent.

|---------|------------|--------|---------|--------|---------|---------|------------|--------|---------|--------|---------|---------|------------|--------|---------|--------|---------|---------|------------|--------|---------|--------|---------|---------|------------|--------|---------|--------|---------|---------|------------|--------|---------|--------|---------|

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The preceding table is one of the tables of the Equitable Society for Annuities on Lives and Survivorships, which has been adopted, with little or no variation, by all the other societies lately established for the assurance of lives. It was computed in the year 1782, when Mr. Simpson's was the only rule in existence. In the middle stages of life it is sufficiently accurate, but it fails when the life in expectation is very old; and in this case recourse is always had, in the Equitable Assurance Office, to Mr. Morgan's correct rule in the Philosophical Transactions. See **ASSURANCE.**

**Explanations.**—The annual premium in this table is supposed to be payable during the joint continuance of the lives of the **pensioner** and **expeitant;** and the first payment is supposed to be made at the time of purchasing the assurance.

The **equivalent annuity** signifies that annuity to which either the single premium, specified in the table, or the **annual** premium, will entitle an **expeitant** during his survivorship, should such an annuity be preferred to a gross sum payable on survivorship. Thus the payment of either £25,588/ (34l. 11s. 11d.) in hand, or of £2,566l. (2l. 11s. 5d.) annually, during the joint lives of a woman aged 25, and a husband aged 35, the first payment to be made immediately, will, according to this table, entitle the husband, should the wife survive the husband, either to 100l. payable to her when she becomes a widow, or to an annuity payable during her life, after becoming a widow, of 6l. 4s. 6d. (6s. 4d.) If she is 35, (or of the same age with her husband,) a single payment of £31,472d., or an annual payment of 2l. 13s. 4d., will, by the table, entitle her to 100l. payable on her survivorship, or to an annuity for her life of 7l. 4s. 6d., after survivorship.

Any payments greater or less will entitle to gross sums or annuities proportionally greater or less.

**PROB. V.**

To find the value of an estate to be entered upon at the decease of B, provided he survives A.

**Answer.**—Find the value of an annuity on the **longest** of two equal lives (see **LIFE-ANNUITIES**), whose common age is that of the older of the two lives A and B, which value subtract from the perpetuity, and take half the remainder.

Then it will be, as the expectation of the duration of the younger of the lives A and B is to that of the older, fo is the half remainder to the number of years' purchase required, when B is the oldest of the two. But if B be the youngest, then to the number of years' purchase thus found, add the value of an annuity on the longest of the lives A and B, and subtract the sum from the perpetuity for the answer in this case.

The value of the reversion in annual payments, till the claim is determined, is found by dividing the single present payment by the value of the two joint lives; and the same value in annual payments, till the claim becomes due, is found by dividing the single payment by the value of the life of B.

**Example.**—Let the age of A be 50, and that of B 60 years. Let the given estate be 400l. per annum and interest at 5 per cent. The value of the longest of two lives, whose common age is 60, is, according to col. 3, Tab. III. and by the rule under **LIFE-ANNUITIES**, 11,474d., which, taken from 25, the perpetuity, leaves 15,526 for the remainder: therefore it will be, as 31,21, the expectation of A by Tab. II., is to 12,63, the expectation of B, fo is 6,762, the half remainder, to 2,733, the number of years' purchase required, which being multiplied by 40, gives 109,32 for the value in one present payment.

But if A had been 60, and B 50, the value required would have been 5,435, multiplied into 40, or 217,411 be-
came the value of the longest of the two lives A and B (by col. 5, Tab. III. and the rule under **LIFE-ANNUITIES**), is 16,828 years' purchase.

This rule of Mr. Simpson is founded on the same principles with his rule in Prob. III.; and is, therefore, equally incorrect in the earlier and later periods of life. The following rule, deduced by Mr. Morgan from the real probabilities of life, and published in the 78th vol. of the Philosophical Transactions, is correct in all cases.

Retaining the same symbols as in the solution of the third problem, the exact value of an estate of 1l. per annum, depending on the contingency above-mentioned, will be

\[ S = \frac{F}{r} - \frac{F}{r} \cdot \frac{A}{B} - \frac{A}{B} \]

when B is the oldest of the two lives. If B is the youngest, the rule is found as directed above, by substituting this from the value of the reversion after the longest of the two lives A and B.

The value of a given sum S may be obtained by multiplying the above expression into

\[ \frac{S}{r} \]

These problems include all the cases of survivorship between two lives for **their whole duration.** The two following problems, given by Dr. Price in his **Treatise on Reversionary Payments,** relate to cases of survivorship between two lives, when the survivorship is restricted to a term of years less than the whole duration of the lives.

**PROB. VI.**

"A, expectant, will lose a given sum, should he survive, within a given time. What ought he to pay for the assurance of it?" In other words: "What ought he to pay for a given sum to be received at the death of A, should it happen to survive him within any given time?"

**Answer.**—Divide the sum of the decrements of life in the Table of Observations, from the age of A, for the given time, by the given sum; and, by the quotient, divide the number of the living in the table at the age of A; and, again, by this second quotient, divide the given sum, referring the third quotient.

[N. B. When the age of A is under 60, and the term is large as to exceed the difference between it and 70, it will be best, when the London table is used, to divide the given sum, not by the second quotient here mentioned, but by the complement of the life of A.]

Find the value of an annuity on the life of B, for the given time. To this value add the quotient, that will arise from dividing the value of an annuity certain, for the given time, by twice the complement of the life of B; and the sum multiplied by the referred quotient, will be the required rate in a single present payment.

**Example.**—Let the Table of Observations be Mr. Simpson's for London. (See Tab. I. under **EXPECTANCE.** Let the rate of interest be 5 per cent.; A, seven years of age; B, 50; the given time 14 years, the given sum 100l. The sum of the decrement for 14 years from the age of 7, is 73, which, divided by 14, gives 5.1. The number of the living at 7 is 430, which, divided by 5.2, and 10th divided by the quotient, gives 137. The quotient to be referred.]

The value of an annuity for 14 years on the life of B, is by Prob. III. under **LIFE-ANNUITIES**, 9.5. The value of an annuity certain for 14 years, is by Tab. III. under **ANNUITIES,** 11,956, which, divided by 9.44 (twice the complement),
SURVIVORSHIP.

Complement of the life of B), gives \( 13 \), which, added to \( 9.5 \), gives \( 22.5 \); and this again multiplied by \( 1.11 \), the referred quotient, gives \( 24.64 \), the present value in one payment of \( 100 \) dr. payable at the death of A, aged \( 7 \), to B, aged \( 30 \), should A die and leave B the survivor within \( 14 \) years.

N. B. The expectation of B is \( 35.6 \) by Tab. II. under Expectation; and it should be remembered, that twice the expectation is always the complement of a life. The present value for \( 14 \) years of two joint lives, one \( 7 \), and the other \( 30 \) a year or more, may be found in the method explained under Life Annuities, to be nearly \( 9 \) years' purchase; and \( 11.646 \), divided by this value, with unity added, or by \( 10 \), gives \( 1.164 \), the foregoing value in annual payments during the joint lives for \( 14 \) years, the first payment to be made immediately, and the left payment at the end of \( 14 \) years, should the joint lives not fail.

Sebulum.—It deserves particularly to be remembered, that in this method likewise may be calculated, what sums ought to be paid on any survivorship, within a given time, of one life beyond another, in consideration of any given sum now advanced. The following example of this is a case which has offered itself in practice.

"A person, aged \( 50 \), has in expectation an estate which is to come to him, provided he survives a minor, aged \( 7 \), before he is out of his minority; that is, provided he should be himself living at the time of the minor’s death, should that happen before he is \( 21 \). In these circumstances, he wants to borrow \( 1000 \) on his expectation. What reservoir out of the estate depending on such a survivorship, is a proper equivalent for this sum now advanced, interest being reckoned at \( 3 \) per cent. and the probabilities of life being supposed the same with those in Mr. Simpson’s Table of London Observations?"

Answer.—It appears from what has been just determined, that for \( 11.646 \) now advanced, the proper equivalent in such circumstances, is \( 100 \) to be paid in case the survivorship should take place; or as much of the estate as \( 100 \) will buy at \( 3 \) per cent., supposing the first rent to be received immediately, that is, \( 2.912 \) per annum. By the rule of proportions, therefore, for \( 100 \), the proper equivalent will be \( 8591 \) in money, or \( 250 \) per annum cut of the estate.

Pro B. VII.

"100 will be left to B’s heirs, should he happen to die after A, within a given time. What is the price of the assurance of it?—That is, what is the present value of \( 100 \) payable at the death of B, provided his death should happen after A’s death, within a given time?"

Answer.—Divide the sum of the decrements of life in the Table of Observations, from the age of B, for the given time, by the given time; and by the quotient divide the number of the living at the age of B; and again, by this second quotient, divide the given sum, referring the third quotient.

Find the value of an annuity on the life A for a number of years, less by one year than the given time, which subtract from the value of an annuity certain for the same number of years. Multiply the remainder by the referred quotient, and divide the product by the amount of \( 11 \) for one year, and let it be a second referred quotient.

Again: Multiply into one another the first referred quotient, and the value of an annuity certain for the given time; and divide the product by twice the complement of A’s life. This left quotient, added to the second referred quotient, will be the answer in a present single payment.

Example.—Let the age of B be \( 40 \) of A, \( 30 \); the sum \( 100 \); rate of interest \( 4 \) per cent; the given time \( 20 \) years; the Table of Observations, Mr. Simpson’s. See Expectation.

The sum of the decrements of life, in this table, from the age of \( 40 \), for \( 20 \) years, is \( 127 \), which, divided by \( 20 \) (the given time), gives \( 6.38 \). The number of the living at \( 40 \) is \( 239 \), which, divided by \( 6.38 \), gives \( 36.8 \); and \( 100 \) (the given sum) divided by \( 36.8 \), gives \( 2.79 \), the first referred quotient to be referred.

The value of an annuity for \( 19 \) years, on a life at \( 30 \) years of age, is \( 10.3 \); which, subtracted from \( 11.646 \), the value of an annuity certain for \( 19 \) years, by Tab. III. under Annuities, and the remainder multiplied by \( 2.79 \), gives \( 7.89 \). This product, divided by \( 1.04 \) (the amount of \( 1l. \) in one year), gives \( 7.60 \); the second referred quotient.

\( 2.79 \) multiplied by \( 13.59 \) (the value of an annuity certain for \( 20 \) years), gives \( 37.916 \); and this product, divided by \( 94.4 \) (twice the complement of A’s life), gives \( 401 \), which, added to \( 7.60 \), gives \( 8l. \) the answer; or the value of \( 100 \) payable at the death of B, on the contingency of his surviving A, aged \( 50 \), and B’s dying in \( 20 \) years.

It is plain that this is likewise the sum that ought to be lent to B now, on the expectation of \( 100 \) at his death, provided it should happen after A’s death in \( 20 \) years.

This rule gives the just solution in all cases, except when B, the expectant, is the youngest of the two lives, and at the same time the term of years greater than the complement of A’s life. In this particular case the following rule must be used.

Find, by the preceding rule, the value of the assurance of the given sum for a term of years, equal to the complement of A’s life, and let this value be referred. Multiply by one another the given sum; the value of \( 1l. \) to be received at the end of a number of years equal to the complement of A’s life; and the value of an annuity certain for as many years as the given term exceeds this complement; and the product, divided by the complement of B’s life, and the quotient added to the value referred, will be the true value sought.

Example.—Let the age of B be \( 30 \) of A, \( 40 \); the term \( 47 \) years; and every thing else as in the last example.

The complement of A’s life is \( 49.2 \). The value of \( 100 \) to be received at the death of B, if he survives A within \( 39 \) years, may be found by the preceding rule to be \( 15.15 \); the value to be referred. The value of \( 1l. \) to be received at the end of \( 39 \) years is, by Tab. II. under Annuities, \( 2166 \). The value of an annuity certain for \( 8 \) years (the excess of the given term above the complement of the life of B) is \( 6.733 \).

And these two values multiplied by one another, and by \( 100 \), give \( 145.83 \); which divided by \( 47.3 \) (the complement of the life of B), and \( 16.15 \), added to the quotient, make \( 10.34 \) the value sought.

Remark.—As after finding the present value of an estate, or annuity, it is necessary to divide that value by the amount of \( 1l. \) in one year, in order to find the present value of a sum equivalent to the annuity; 10, after finding the value of a sum, it is necessary to multiply that value by the said amount, in order to find from it the value of an equivalent annuity.

In the first example, therefore, the value of an estate of \( 1l. \) per annum, would be \( 8.32 \); in the second example, \( 20l. \) and this is, as it ought to be, the value for the whole duration of the lives.

The cases in which three lives are involved in the survivorship are so numerous and complicated, that it would far exceed the limits of this article to enter into a minute investigation of them. The four following problems, however,
SURVIVORSHIP.

being almost self-evident, require no explanation: the remaining ones are all taken from Mr. Morgan’s Treatise on the Doctrine of Annuities and Assurances, with the exception of Prob. XII., which has been taken from his paper in the Philosophical Transactions for the year 1789, to which the reader is referred for its demonstration.

PROB. VIII.

To find the value of an annuity of 1l. during the life of A, after the extinction of the lives of B and C.

Solution.—From the value of an annuity on the longest of the three lives, deduct the value of an annuity on the longest of the two lives of B and C; the remainder will be the number of years’ purchase required: so that if A, B, C represent the values of annuities on the single lives of A, B, and C; A B, A C, and B C, the values of annuities on the two joint lives of A and B; A and C, B and C, and A B C, the value of an annuity on the three joint lives, the value required by Prob. IV., and the rule under Life-Annuitates, will be A + B + C - A B - A C - B C + A B C - B C + C B = A + A B C - A B - A C - B C.

Example.—Let the ages of A, B, and C, respectively, be 24, 46, and 48, the rate of interest 4 per cent., and the probabilities of life as among males and females collectively in the kingdom of Sweden. By Tab. III. A is equal to 10.862; by Tab. IV. Life-Annuitates, A B C may be found = 9.372; and by Tab. IV. and V. A C and A B are equal to 12.801 and 10.862: hence the required value will be 2.706 1/4, or 2l. 12s. 6d. nearly.

PROB. IX.

To find the value of an annuity of 1l. during the life of A, after the extinction of the joint lives of B and C.

Solution.—Deduct the value of an annuity on the three joint lives, from the value of an annuity on the single life of A, and the remainder will be the answer.

Example.—Supposing the ages, the rate of interest, and the probabilities of life, to be as in the preceding problem, the value in this case will be 16.997 - 9.372 = 7.625, or 7l. 12s. 6d.

PROB. X.

To find the value of an annuity of 1l. during the longest of the two lives of A and B, after the decease of C.

Solution.—From the value of an annuity on the longest of the three lives (found by Prob. IV. Life-Annuitates), deduct the value of an annuity on the single life of C, the remainder will give the value required; or retaining the same symbols as in Prob. VIII., it will be A + B + A B C - A B - A C - B C.

Example.—The ages of A, B, and C, the rate of interest, and the probabilities of life, being as in the two preceding problems, the value will be 16.997 + 14.939 + 9.372 = 34.208; and by multiplying each of these by 100, the value is 3420.8. Also, if the lives are all equal, the value will be 7.625.

PROB. XI.

To find the value of an annuity during the joint continuance of the two lives of A and B, after the decease of C.

Solution.—Find (by Prob. IV. under Life-Annuitates) the value of an annuity on the three joint lives; deduct this from the value of the two joint lives of A and B; and the remainder will be the answer.

Example.—Let the ages be 30, 42, and 60, the rate of interest 4 per cent., and the probabilities of life as among males and females collectively in the kingdom of Sweden.

By Prob. IV. under Life-Annuitates, and Tab. IV. in this article, the value of the three joint lives may be found = 6.998; and by the same table, the value of the two joint lives of A and B is 11.543; the value required, therefore, will be 4.545, or 4l. 11s. nearly. Had the ages been 14, 36, and 48, the value would have been 12.801 - 9.372 = 3.429, or 3l. 8s. 6d. nearly.

PROB. XII.

To determine from any Table of Observations the value of a given sum, payable on the contingency of C’s surviving B, provided the life of A shall be then extinct.

Solution.—Let k represent the number of persons living in the table at the age of K, a person one year younger than C; β the same number at the age of P, a person one year younger than B; ε and δ the number of persons living at the respective ages of C and B; m the number of persons living at the age of F, a person one year younger than B; and d the same number at the age of T, a person one year younger than C. Let F K, A F K, B K, A B K, &c. be the value of an annuity on the joint lives of F and K; A, F, and K; B and K; A, B, and K, &c. Let r be 1l. increased by its interest for a year, and S the given sum; then will the value required, when either B or C are the oldest of the three lives, be

\[
\begin{align*}
\beta \cdot F K - A F K & \cdot B K - A B K + S \cdot b \\
FC - AFC & \cdot S \cdot \frac{r - 1}{3r} \cdot BC - ABC - S \cdot m \\
FC & - APC + S \cdot \frac{d}{6r} \cdot BT - ABT - S \cdot \frac{m \cdot PT - APT}{b}
\end{align*}
\]

If A be the oldest of the three lives, let α represent the number of persons living in the table at the age of A, j the same number at the age of B; L the number at the age of N; and let the former quantities denote, as in the former case, the values of the joint lives H and K; of H, I, and K; of A, B, and K, &c. Further, let R denote the value of the given sum, payable if C should survive B, found by

Prob. II., then will the value required be

\[
R = \frac{A H K - H B K + A K - A B K}{a} + \frac{H C - H B C}{6a} + \frac{N C - NBC}{6a} + \frac{S \cdot r - 1}{6r} \cdot X
\]

If the lives are all equal, the value will be

\[
S \cdot \frac{r - 1}{6r} \cdot X
\]

V - 3 C C - 2 C C C, where V denotes the perpetuity.

Mr. Simpson, in his Select Exercises, has given the following solution of this problem, founded partly on M. De Moivre’s hypothesis, and which is a sufficiently near approximation in those cases where neither of the lives is very young or very old.

Case 1.—If the life C be the oldest of the three; From the value of an annuity on the life of C, take the value of the two joint lives B and C; multiply the remainder by the given
given sum, and the product divided by twice the expectation of \( A \), will give the value sought.

\textit{Cæsa 3.---If the life of \( B \) be the eldest of the three.} From the value of an annuity for as many years as \( C \)'s life as are expressed by the double of \( B \)'s expectation, subtract the value of the two joint lives \( B \) and \( C \); multiply the remainder by the given sum, and divide the product by twice the expectation of \( A \), as in the preceding case.

\textit{Cæsa 3.---If the life of \( A \) be the eldest of the three.} Find the value of the life \( C \), if older than \( B \); otherwise find the value thereof for as many years as are expressed by the double of \( B \)'s expectation. And from the value thus found, let the value of the joint lives \( A \) and \( C \) be substracted; multiply the remainder by the given sum, and the product, divided by twice the expectation of \( B \), will give the answer in this case.

\textit{Example.---Let the age of \( C \) be 25, that of \( B \) 49, and that of \( A \) 30. Let the given sum be 1000l., the rate of interest 4 per cent., and the probabilities of life as they are among males and females in the kingdom of Sweden. This example, it is plain, belongs to \textit{caèsa 2.} The expectation of \( B \) by Table II. being 19.09, the double of it will be 38.18. The value of an annuity on the life of \( C \) for 38.18 years by Table III., and the third problem under the article \textit{Life-Annuities}, is 15.032, from which deducting 10.613, the value of the joint lives of \( B \) and \( C \) by Table V., we have 4.42, which being multiplied into 1000, and the product divided by 63.42, or twice the expectation of \( A \) by Table II., the quotient 86.196l., or 86l. 5l. 10d., will be the value required.

\textbf{PROB. XIII.}

To find the value of a given sum payable on the death of \( A \), if his life should be the \textit{first} that fails of the three lives of \( A \), \( B \), and \( C \).

\textit{Solution.---Find by Prob. XII. the value of the given sum payable, if \( C \) (the elder of \( B \) and \( C \)) should be living at the decease of \( A \), in case \( B \) is then dead. Find next by Prob. III. the value of the given sum payable, if \( C \) is living at the decease of \( A \), whether \( B \) is then living or not. Subtract the former value from the latter, and the remainder will be the value required.}

\textbf{PROB. XIV.}

To find the value of a given sum payable, if \( A \) should be the \textit{second} that fails of the three lives \( A \), \( B \), and \( C \).

\textit{Solution.---Find by Prob. III. the value of the given sum on the contingency of \( C \)'s surviving \( A \), and also on the contingency of \( B \)'s surviving \( A \). Find by Prob. XIII. the value of the given sum on the contingency of \( A \)'s life being the \textit{first} that fails. From the sum of the two former substract twice the latter value, and the remainder will be the value required.}

\textbf{PROB. XV.}

To find the value of a given sum payable on the death of \( A \), if his life should be the \textit{last} that fails of the three lives of \( A \), \( B \), and \( C \).

\textit{Solution.---Find by Prob. XII. the value of the given sum payable, if \( C \) should live till the decease of \( A \), in case \( B \) should then be dead \( C \) being supposed the elder of \( B \) and \( C \). Find next by Prob. V. the value of the given sum payable, if \( A \) should die \textit{after} \( B \). Subtract the former value from the latter, and the remainder will be the value required.}

\textbf{PROB. XVI.}

To find the value of a given sum payable on the extinction of the lives of \( A \) and \( B \), should they be the \textit{first} that fail of the three lives of \( A \), \( B \), and \( C \).
SURYA, in Hindu Mythology, is the common name of the Sun, or rather a personification of that luminary. In all idolatrous nations, among all people indeed unenlightened by revelation, the Sun was an object of early and ardent adoration. (See Idolatry.) With the Hindoos, the Sun appears to have been almost universally invoked, and by the lower classes no doubt superstitiously; but by Brahmanas and the initiated, it is adored typically of that divine and incomparably greater light, which illumines all, delights all, from which all proceed, to which all must return, and which alone can irradiate (not our visibl organs merely, but our souls and) our intellects." Thence, as we are told by Sir W. Jones, may be considered as the words of the most sacred text in the Indian scripture. See Om.

We must not be surprised, as remarked by the same author, at finding, on a close examination, that the characters of all the Pagan deities, male and female, melted into each other, and at last into one or two: for it seems a well-founded opinion, that the whole crowd of gods, of good deities in ancient Rome and modern Benares, mean only the powers of nature, and principally those of the Sun, expressed in a variety of ways, and by a multitude of fanciful names. A plausible opinion has been entertained by learned men, that the principal source of idolatry among the ancients, was their enthusiastic admiration of the Sun; and that when the primitive religion of mankind was lost amid the distractions of establishing regal governments, or neglected amid the amusements of vice, they ascribed to the great visible luminary, or to the wonderful fluid of which it is the general reservoir, those powers of pervading all space, and animating all nature, which their wiser ancestors had attributed to One Eternal Mind, by whom the substance of fire had been created as an inanimate and secondary cause of natural phenomena. The mythology of the East confirms this opinion; and it is possible that the triple divinity of the Hindoos was no more than a perfonification of the Sun, whom they call Triyutu, or three-bodied, in his triple capacity of producing forms by his genial heat, preserving them by his light, or destroying them by the concentrated force of his igneous matter. (See Pavanaka.) This, with the wild conceit of a female power (of which see under Sakti), united with the godhead, and ruling nature by his authority, will account for nearly the whole system of Egyptian, Indian, and Grecian polytheism, distinguished from the sublime theology of the philosophers, whose understandings were too strong to admit the popular belief, but whose influence was too weak to reform it.

So grand a symbol of the Deity as the Sun "looking from his fole dominion like the God of this world," will of course have attracted the earliest adoration, and almost necessarily have been the primary and principal object of idolatry and superstitition. The investigators of ancient mythology accordingly trace to this source, wherein they are re-absorbed and lost, almost every other mythological personage, who, like his own light, diverge and radiate from his glorious orb; or, in the words, and in the popular feile, of the sacred text above quoted, "whence all proceeded, and to which all must return. But the Brahmanas and the initiated deities are as implied by the interpolated gloss on the sacred text, the application of this attribute of "all-producing, all-absorbing" to the Sun. The noble truth, so well expressed in the concluding stanza of an ode addressed to Surya by the elegant writer already named, is fully recognized by intelligent Hindoos.

"Yes! though the Sanfrict fong
Be fraught with fancy's wreathes, and
And emblems rich, beyond low thoughts refer'd,
Yet heav'nly truth it breathes
With atf hection aright.
That, loftier than thy sphere, the Eternal Mind,
Unmov'd, unrival'd, undefin'd,
Reigns with providence benign.

—Since thou, great orb, with all-enlightening ray,
Rulest the golden day,
How far more glorious He, who said serene,
Be—and thou wait—Himself uniform'd, unchang'd,
Unseen!"

Praising by the popular belief of the divinity of Surya, or the Sun, we find the Hindoos ascribing to him the properties or attributes of the three persons or powers that constitute mythology and form their trimurti, or Trinity, as it hath been usual to call it, or that, physically contemplated, are the secondary causes of natural phenomena. (See Siva and Trumurti.) It is noticed above, that one of the names of the Sun is Triyutu, or in shorthand Trisus, meaning three-bodied, as embracing the creative power of Brahman, in his capacity of producing forms by his genial heat; the progressive power of Vishnu, in the property of light; and the destructive energy of Siva, in the concentrated force of his igneous matter. And where these are in fact the attributes of the One God, the Eternal Mind, of Hindoo theologians, He is called Brahman. The Sun, or Surya, is therefore desired to be Brahman, Vishnu, and Siva. At night and in the Wd., he is Vishnu; he is Brahman in the East and in the morning; from noon to evening he is Siva. We know of no reason for this arrangement.

Surya is usually represented in pictures four-handed, seated in a golden car drawn by seven green horses, a simile encircling his head, and sometimes blazing round the whole. Sometimes his car is drawn by one horse with seven heads. (See Ochzubava and Shazza.) A legible character, with a red face, named Aruna, guides the charriot with most of variegated hue. But we are deduced, by the poetical allusion that so pleasingly distinguishes the Hindoo Phoebus and Apollo, to refer to again to the hymn addressed to this "lord of the lotus."

"Whole substance Indra with his heav'nly bands,
Nor fogs nor underfands;
Nor ev'n the Vedas three to man explain.
His mystic orb triform, though Brahman turn'd in train."

"First o'er blue hills appear,
With many an agate hoof,
And patterns fring'd with pearl, seven coursers run;
Nor boast'st thou arched woof.
That girds thee with spheres,
Such hear'st a span threads of colour'd light sere,
As ting in the reins which Aruna guides.
Glowing with immortal grace,
Young Arum, loveliest of Vinataian race;
Though younger be, whom Madhava bestrides,
When high on eagle-plumes he rides.
But Oh! what pencil of a living for
Could paint that gorgeous car,
In which, as in an ark, supremely bright,
The lord of boundless light,
As resting calm o'er the bay, the rocks fail,
And with ten thousand beams his awful beauty reigns."

Oh
SURYA.

On the above lines we have to observe, that Surya’s seven horses, as well as Aruna’s variegated reins, are supposed to have reference to the tints of his preceding raś; but we have yet to learn if the Hindoos have attained a knowledge of optics warranting a supposition of their being acquainted with the prismatic divisibility of a ray of light. The regents of the sun and of fire, intimately connected as their primary properties are, we may expect to find agreeing in their emblems or attributes. Thus, Surya’s “mythic orb triform,” and Agni’s “triplicate of legs,” are deducible from the three descriptions of sacred fires venerated by the Hindoos, and proceeding from, and re-absorbed in, the sun, as the three great powers of nature proceed from, and return to, the Eternal Mind. Of these sacred fires, see under our article PAVAKA. We may thus discern an additional reason for a people of idolatrous propensities identifying the sun with Brahm, or that being who said Ṛṣi and the sun ēsas. Surya’s seven horses, and Agni’s seven legs, are again referable to the idea of the common properties of light and heat. On this point also, see PAVAKA.

The theory of the learned author of the Analysis of Ancient Mythology, would in great measure have derived a considerable accession of strength in his mind, had he been professed of the speculations of the Hindoos on the universality of the sun. Sir W. Jones, not altogether agreeing with Newton, that ancient mythology is nothing but historical truth in a poetical dress; nor with Bacon, that it confuted in moral and metaphysical allegories; nor with Bryant, that all the heathen deities are only different attributes and representations of the sun, or of deceased progenitors; reasonably conceived that the whole system of religious fables rove, like the Nile, from several distinct sources; and inclined to the opinion, that one great spring of idolatry, in the four quarters of the globe, was the veneration paid by men to the sun; and another, the immediate respect shown to the memory of deceased ancestors, especially the founders of kingdoms, legislators, and warriors, of whom the sun and moon were wildly supposed to be the parents. Of the great respect shown by the Hindoos to the memory of departed ancestors, see our article ŚRĀMA; and of the idea of solar and lunar races of mortals, see RAMA and SURYAVANSA.

Although the sun is found, in the Hindoo system, to include the three great powers, Surya externally more resembles Viṣṇu than either of the others. His forehead is marked with the sectorial hieroglyphic of the Viśāvatvas, that is, with perpendicular lines; the Śaivas, or Śeṣāṅkṣis of Śiva, marking their and their gods’ foreheads with horizontal lines. Surya is also frequently seen with Viṣṇu’s monomēt attributes, the shank or shell, and loto’s. Viṣṇu is farther considered as more immediately the sun, than either Brahma or Śiva; and his most glorious incarnation in the person of Kṛṣṇa is of direct solar reference. Among the names of Surya will be found both Viṣṇu and Kṛṣṇa; and it may be here remarked, on the authority of general Vallancey, that Kṛṣṇa is the sun in Ṣanskrit as well as in Saṅskrit; and Arun is the precursor of the sun (that is, the dawn, Aurora) both in Ṣanskrit and Hindoo mythology. See TRIVENI.

The extract from Sir William Jones’s hymn given above, adverts to the equipage of Madhava “borne on eagle-plumes,” being, like Aruna, “of Vinarian race.” This alludes to the man-eagle of Madhava or Viṣṇu, the Indian Jove, which vehicle, or mascot, is named Supreme, brother of Aruna, and son of Vinata. See SUPREMA, VINATA, and YAMA.

The names of the sun are numerous among the Hindoos. It is said they amount to nearly fifty, which limits will not allow us to introduce. It may lead to extended speculation, to consider that the primary name of the sun means the Attractor. See Sir William Jones’s admirable essay “On the Philosophy of the Aṣṭāṅgas,” in the 4th volume of the Aṣṭāṅga Researches, and in his Works, edited by Lord Teignmouth.

As well as many other of the Hindoo deities, Surya has wives alluded to him. These sexual tales are allegorical of the powers or attributes of the principal. These hiepabetes are termed Sāśi; which see. The comfort of Surya that we often left read of is Prabha, which means brightness or effulgence.

Under the article SOMA, it is shewn that the Hindoos, like some other diffus people, generally consider the moon as a male deity; and as conjunctions of the sun and moon are a common language with all astrologers and mythologists, we find sexual fables invented for bringing them together, and into separations, or oppositions. The sun and moon are, therefore, both male and female with the Hindoos, and are duly married, separated, &c. The Greeks had similar tales. Bacchus is sometimes spoken of as the sun, and the offspring of the moon, sometimes as brother to Luna. See Potter’s Arch. Graec. c. xix.

Among the Anglo-Saxons, as we are told in Turner’s History, the moon was a male and the sun a female deity; and the same peculiarity of gender, the author says, obtained in the ancient northern language. It is curious, he farther remarks, that in a passage of an Arabian author (in Not. ad Carmen Tograti, p. 13.), we meet with a female sun and masculine moon. The diūthich is,

"Nec nomen femininum Soli dedecus, Nec masculinum Lunae gloriam."

There is also a solar race in Hindoo fable, like the Heliades of Greece, and the similar families of the Peruvians. Suryavansa, or offspring of Surya, is the Sanctific designation of these illustrious descendants. (See SURYAVANSA.) The river Yamuna, called Jumna by European geographers, is riled in Hindoo poetries, “the blue-eyed daughter of the sun.” See YAMUNA.

So early as the appearance of the first volume of that noble deposit of Oriental lore, the Aṣṭāṅga Researches, Sir William Jones, in his very curious dissertation on the gods of Greece, Italy, and India, had discovered many striking and unsuspected coincidences. On the subject of the offspring of Surya, and his avatars or descents on earth, we will here extract a passage from that dissertation. “Surya is believed to have descended frequently from his car in a human shape, and to have left a race on earth, who are usually renowned in the Indian stories with the Heliades of Greece. It is very singular that his two sons, called Āfwina, or Āfwini-Kumara in the dual, should be considered as twin brothers, and painted like Cato and Pollux; but they have each the character of Eklepius among the gods, and are believed to have been born of a nymph, who, in the form of a mare, was impregnated with fun-beams. I suspect the whole fable of Kalypso and his progeny to be astronomical; and cannot but imagine that the Greek name Calipopsis has a relation to it.” This idea has been fully confirmed by Mr. Wilford’s ingenious essays in the subfollow ing volumes of the Aṣṭāṅga Re researched. (See KALYPSO, in which article, line 7, for att, read att.) In the 11th volume, art. ii., it is shewn, that the name of Eklepius is also Sanctific; in which tongue, Afwikulapu, a name intimately connected with the Difciur of Hindoo fable, means chief of the tribe of Avi; it means also mare-destroyed. The name, country, and history of Eklepius having
having so much puzzled the Greeks and other fabulists, gives a great probability of the whole story having originated with the Hindoos, in whose books a great deal respecting it may be found.

The worship of Surya, from what has been said, may be supposed very extensive in the Hindoos. Tho' of the sect who exclusively worship him are called Saura. But besides those who may be said to worship the sun exclusively, a great many other sects make joint adoration and offerings to him with other deities.

Reference being made from the article O'M to this, we will here take occasion to correct two or three errors of the prefix, that have crept into that article; in vol. 5. l. 37 from the bottom, for researches, read researques; l. 27 from the bottom, for monyssylabic, read monoyssylabic; l. 4 from the bottom, for of one their, read of one their; in col. 6. l. 24 from the top, for composed of a, read composed a.

Representations of Surya are very common throughout India, in pictures, sculptures, and casts; both separately and associated with other deities. Several engravings of him, in both fictions, are given in, the Hindoo Pantheon, from the three several originals. He is seen seated in his car, surrounded by a blaze of glory, drawn by seven foaming steeds, or by one seven-headed, drawn by the imperious horse, Aruna. And he is described as followed by thousands of worshiping him and modulating his praises. The following is a translation of the first verse of a hymn addressed, with obligations, to the regents of the nine planetary spheres, extracted from Colebrooke's essay "On the Religious Ceremonies of the Hindoos," in the 7th volume of the Asiatic Researches. "The divine sun approaches with his golden car, returning alternately with the shades of night, routing mortal and immortal beings, and surveying worlds. May this oblation to Surya be efficacious!" In some zodiacal representations, Surya is mounted on a lion, and placed in the centre, indicating an early knowledge of the true solar system. (See ZODIAC.) His car is sometimes followed by a black ill-favoured figure, a personification, probably, of the darkness that the god of day is dispelling.

Enthusiastic devotees are encouraged to penances in honour of different deities, by stances in their sacred romances of boons having been heretofore obtained through the favour of the deities so propitiated. Gazing on the sun, a mode of moving Surya's favour, must be exceedingly hurtful and distressing. So important are the penances, that the modes and objects of performance have been reduced to a system. The penance is generally termed Tapas; which see. For farther particulars, see the Hindoo Pantheon.

SURYA-SAVITRI is a name of the sun, or rather two of his names joined, masculine and feminine; the Hindoo Phoebus being of both sexes. Of this, and other points connected with the important regent of the sun, see Surya and Savitri.

SURYAVANSA, in Hindoo Romance, is the name of a solar race of mortals: offspring of the sun is the best translation of the compound word; Surya being the sun; of its regent, corresponding with the Phoebus of European heathens. In the older histories extant in India, it is usual to designate the heroes as being of the solar or lunar race.

SURZUR, in Geography, a town of France, in the department of the Morbihan; 6 miles S.E. of Vannes.

SUS, or Susis, a river of Africa, which rises at Ras-el-Wed, about 30 miles from the city of Terodan, in the empire of Morocco, at the foot of mount Atlas, and discharges itself into the ocean, about six miles S. of the town of Santa Cruz. At its mouth is a bar of sand, which at low water separates it from the ocean. It gives name to a province, which it bounds on the south.

SUS, a town of Peris, in the province of Chufian; 45 miles N.W. of Susa.

SUS, Susa, or Susis, the most extensive, and, if we except grain, the richest province in the empire of Morocco; it is the most southerly province of the empire, and is bounded on the N. by a part of the Atlas, on the E. by Darah, or Dra, on the S. by Nune, or Vdie de Nune, and on the W. by the Atlantic. It contains many warlike tribes, both Arab and Shelluks. The climate is remarkably fine; hot in the months of June, July, and August, and about the beginning of September, the thyme, or hot wind from Sahara, blows during three, four, fourteen, or twenty-one days. Their violent winds are succeeded by the rainy season. The soil is in general fertile; and it produces figs, cotton, indigo, gum, and various kinds of medicinal herbs. The thick lizzare's fo abundant, that it is called (afk Suf) the root of Sus. The olive plantations are very extensive, and those of the almond are abundant. It is said that Sufis produce more almonds and oil of olives, than all the other provinces collectively. Of corn, the inhabitants of this province cultivate only enough for their own annual consumption, and they pay little attention to the vines. Dates are found here in perfection. Wax is very abundant; and so are aloes, gum euphorbium, gum sandarsch, wild thyme, worm-wood, orris-root, orchis, weed, and coloquintia. Antimony, folsuite, iron, copper, lead, silver, and gold, are found here. It is also richly furnished with a variety of quadrapeds, birds, and fish. Its chief towns are Terodan, Aqaudeer, or Santa Cruz, Aka, Teko, and Meffa. Sus was formerly a province of great trade, on account of its connection with the southern districts; but when the Santa Cruz was destroyed, it was deprived of many of its resources and conveniences for trade. Its inhabitants, who are very numerous, are generally reckoned more brave and industrious than others of Morocco; and many of them, especially in the mountainous districts, are governed by their own sheiks, and acknowledge no obedience to the emperors.

SUS, the Hog, in Zoology, a genus of the class and order Mammalia, Bello, of which the generic character is as follows: The four upper fore-teeth are convergent; the lower fix are prominent; the two upper tusks are shorter; the two lower flanging out; the front prominent, truncate, and moveable; and the feet are mottly cloven. The individuals of this genus dig in the earth with the front, which is furnished at the end with a strong, round cartilage; they feed indifferently upon almost every thing, even the most filly; they wallow in the mire, and are in general extremely prolific. There are fix species.

*SCROFA; Hog. Back brilly on the fore-part; the tail is hairy. There are two varieties: 1. Tail hairy; or short, roundish; being the wild hog. 2. Tail hairy; or long, acute; being the common hog; which is beloved by those that have their hogs undivided; and into whose whole backs are nakedly, belly reaching almost to the ground. This is the Chinese hog, as it is denominated.

The common hog is found, either in a wild or domestic state, in almost all the temperate parts of Europe and Asia; but it is not met with in the moat northern parts of these continents. It is found in many parts of Africa. Dr. Shaw remarks, that it is not indigenous to the British Isles; but Mr. Pennant affirms that the wild boar was formerly a name of this country, as appears from the laws of Holc dda, who permitted his grand huntman to chase that animal from the middle
middle of November to the beginning of December. William the Conqueror was satisfied with the loss of eyes those that were convinced of killing the hog, or the ree-buck; and it is assayed by Fitz-Stephen, that the vast forest which in his time grew on the north side of London, was the retreat of hogs, wild boars, and bulls.

The wild boar inhabits woods, living on various kinds of vegetables, such as roots, maize, acorns, &c. It also occasionally devours animal food: it is in general considerably smaller than the domestic hog, and is of a dark brindled-grey colour, sometimes blackish; but when only a year or two old, it is of a pale red or dull yellowish-brown coat; and when quite young, it is marked with alternate duney and pale stripes, disposed longitudinally on each side the body. Between the bristles, next the skin, is a finer or softer hair, of a woolly or curling nature. The snout is somewhat longer in proportion than that of the domestic animal; but the principal difference is in the superior length and size of the tusks, which are often several inches long, and capable of inflicting the most severe and fatal wounds. The hunting of the wild boar forms one of the principal amusements of the great in some parts of Germany, Poland, &c. and is a chase of some difficulty and danger, not on account of the swiftness, but the ferocity of the animal. Wild boars, according to Buffon, which have not puffed the third year, are called by the hunters beasts of company, because previous to that age they do not separate, but follow their common parent. They never wander alone till they have acquired sufficient strength to repel the attacks of the wolf. These animals, when they have young, form themselves into flocks, and it is upon this alone that their safety depends. When attacked, the largest and strongest front the enemy, and by preying all around, force them into the centre. Of the same hog, white is the most general colour; but other colours are often intermixed in various proportions. In some respects, the hog seems to form an intermediate link between the whole and the cloven-footed animals; in others, he seems to occupy the same rank between the cloven-footed and digitated. Delineate of horns; furnished with teeth in both jaws; with only one stomach; incapable of rumination; and producing at one birth a numerous progeny: the union of these faculties confers on the hog a remarkable peculiarity and advantage. He does not, like other animals, shed his fore-teeth, and put forth a second set, but retains his first set for life.

Hogs seem to enjoy none of the powers of sensation in eminent perfection. They are said to be deaf and dim-sighted; and the wild boar distinguishes the scent of the hunter and his dogs, long before they can approach him. But so imperfect is their feeling, that they suffer mice to burrow in the fat of their backs without discovering any uneasiness, or appearing even to notice it. In their tale they flew a flingral degree of caprice. In the choice of herbs they are more delicate than any other herbivorous animal, yet devour the most nauseous and putrid carrion with more voracity than any beast of prey. At times they do not scruple to eat their own young; they will even mangle infants out of desperate voracity.

The hog is remarkable for the smallness of his eyes: hence a person whose eyes are very diminutive, and deep sunk in his head, is said to be pig-eyed. The form of the hog is indelicate, and his carriage is equally mean as his manners. His unwieldy shape renders him less incapable of swiftness and frigidity, than he is of gracefulness of motion. His appearance is always drowsy and stupid. He delights to bathe in the sun, and to wallow in the mire. An approaching form seems to affect his feelings in a very sigular manner. On such occasion, he runs about in a frantic state, and utters loud shrieks of horror.

The hogs are often very troublesome in cultivated grounds, ploughing them up with their snouts, and thus entirely frustrating the labours of the agriculturalist. Worms, the wild carrot, and other roots, are the objects of their search. The wild boar having a longer and stronger snout than the domestic, digs deeper, and continues his furrow nearly in a straight line. The inhabitants of America find the hog very beneficial in clearing their lands of rattlesnakes and other serpents, upon which it constantly prey, without apparently suffering any injury.

The sow brings forth in the beginning of the fifth month after conception, and she has often two litters in a year. She generally produces a numerous progeny at a birth; but her first litter is less numerous than those that follow. Hogs, when suffered to see the natural term of life, live from 15 to 50 years. Their size and strength continue to improve till they are five or six years old. They are infested with lice, and are subject to many disorders, such as the scurry, icab, and farcula.

Contemptible as the hog may appear, he is, in a very considerable degree, beneficial to mankind. His flesh is pleasant, substantial, and nutritious. It affords magnificent materials for the table of the epicure; among these is a brawn, which seems peculiar to England. Pork takes salt better than the flesh of any animal, and is, in consequence, preserved longer, and always makes an important article in naval stores. The lard of the hog is used in various medical preparations, and is compounded by the perfumer into pomatum. The bristles are made into brushes, and are, moreover, of great use to the shoemaker. The skin is worked into coverings for pocket-books, and other articles.

The Chinese hog is distinguished from the common, by having the upper part of its body almost bare, its belly hanging nearly to the ground; its legs are very short, and its tail still more disproportionately short. The flesh of this variety is whiter and more delicate. The colour is commonly a dark grey. It abounds in China, and is diffused through New Guinea, and many islands in the South Sea. The New Hebrides, the Marquises, the Friendly and the Society islands, pollute this animal, and cultivate it with great care, as it is almost the only domestic animal of which they can boast.

PORCUS; the Guinea Hog. Back brightly on the hind parts; tail reaching to the ground. A variety has erecct ears, a little pointed; the tail reaching nearly to the ground. It inhabits Guinea; and the variety is found chiefly at Siam. It is less than the hog; the tail is naked; ears long and pointed; the body is red; hair longer on the head and buttocks.

TAJABU; Peccary, or Mexican Hog. Back with a glandular orifice; it has no tail. The tails of this species are scarcely conspicuous, when the mouth is shut; the ears are short, erect, pointed; the eyes are funk in the head; the neck is short and thick; the bristles are nearly as large as those of the hedge-hog, long on the neck and back; in colour it is hoary, black, annulate with white; from the shoulders to the breast is a collar of white. In fine and figure this animal bears an imperfect resemblance to the hog of China. From the gland on the back constantly difficult a thin fetid liquor, which is the most remarkable peculiarity of this species. The first Europeans who became acquainted with this animal imagined the gland referred to was the navel.

The habits of the Mexican hog are not very different from those of Asia and Europe. It is found in great abundance...
dance in all the warm climates of South America. Their instincts, and arms of offence and defence, are the same as those of our own hog, but their teeth never yet set upon anything more gregarious. They are usually found associating together in parties. Though only an individual be singled out, the whole body of the animal is against an enemy. They groan with a stronger and harsher voice than the hogs of Asia and Europe. Forests are their favourite haunts; they do not frequent like our own hogs or the wild boar, to marshes and mires. Fruits, seeds, and roots, are their chief food; but they will devour with great eagerness serpents, toads, and lizards; and they display great dexterity in tearing off the skins of their reptiles; but they do not swallow and become fat, like the common hog. They produce a number of young at each litter, and the mother treats them with the tenderness and solicitude of a kind parent. Though existing in a wild state, they are susceptible of domestication, but nothing can overcome their natural fickleness. Beasts of prey, no less than man, are hostile to this species. The American leopard, or jaguar, one of their most formidable enemies, offers themselves to them, and commits upon the herd the most cruel slaughter. If killed in the night season, provided the ground on the back be taken off, and the liquor which it secretes carefully washed away at the instant of death, the flesh of the Mexican hog is reckoned agreeable food.

AFRICANUS; Cape Hog. Two fore-teeth in the upper jaw. This hog is of a superior size, and peculiar to Africa. It is found in abundance between the Cape de Verde and the Cape of Good Hope. The head is long; the snout slender; tusks large, and hard as ivory; and that in the upper jaw thick, and truncated obliquely; the ears are narrow, erect, and pointed; the tail is slender, and terminating in a tuft reaching down to the highest point of the leg; both jaws furnished with twelve grinding teeth; the body is covered all over with long fine bristles. This species has sometimes been confused with the ethiopicus (next to be described); but the form of the head, the structure of the mouth, and the manner in which the body is covered, establish a sufficient specific difference.

ETHIOPECUS; Ethiopian Hog. This species has no fore-teeth; under the eyes is a soft wrinkled pouch. It inhabits Madagascar, and the bot parts of Africa. They are, in fact, diffused from Sierra Leone to Congo. The manners and economy of this species are but very imperfectly known. They live chiefly under ground, where the texture of their flesh enables them to make their way as readily as the mole.

The Ethiopian hog is nearly five feet long, and between 24 and 30 inches in height; the body is thick and broad; the snout is somewhat prominent; the mouth is narrow, as well as destitute of fore-teeth, but it is furnished with hard gums to supply their functions; the tusks in the lower jaw are small, in the upper very large; the eyes are small, and situated high in the fore-head, the horizontal lobe or wattle under them intercepting from the sight of the animal all objects placed immediately below. The skin is of a dulky hue; the bristles thinly dispersed in separate parcels over the body, between the ears and on the shoulders longer than on any other part.

BABYRUSUS. Two crooked tusks piercing through the upper part of the face. It inhabits the islands of the Indian ocean; is gregarious; feeds on herbs and leaves; of quick scent; swims and dives well; grunts: it is the fize of a stag, and the flesh is good. See BABYRUSUS.

SUS AFFRITIS. See WILD BOAR.

SUS PICTUS, in Leichthyology, a name given by Ovid, and some other of the ancient writers, to the fish called Ἁρτος και κέρας, and by the later writers caprifius. See GOAT FISH.

SUSA, in Geography, a town of Africa, in the kingdom of Tunisia, near the E. coast, near which are considerable remains of ancient buildings. The chief trade of the place is for oil and linen, and it may be reckoned one of the most considerable and wealthy towns of the Tunises. Here are several vaults, granite pillars, and other parts of its having been formerly a place of some repose; probably one of those towns which submitted to Caesar in his march to Rufspinus; 24 miles E. of Cairoan. N. lat. 35° 46'. E. long. 10° 3'.

SURA, a town of Persia, in Khorassan; 150 miles S.E. of Nezibfahr. N. lat. 36° 16'. E. long. 59° 49'.

SURA, called in Scripture Shubban, in Ancient Geography, a town of Persia, and the metropolis of the province of Sultana. It was built on the banks of the Eoleus (called by the prophet Daniel, Ulai) by Memnon, as one of the sons of Tithonus, who was slain by the Thetians in the Trojan war. Strabo and Faustinius compare the walls of Sura with those of Babylon. It was called Susa, from the number of lilies which grew in its vicinity, as Stephanus says, and in the Persian language bore that name. It is also called "Memnonia" by Herodotus and others, from Memnon, its founder. The city was sheltered by a high ridge of mountains from the northern winds, which rendered it very agreeable during winter, and the refuge of the kings of Persia; but in summer the heat was so parching, that the inhabitants were forced to cover their houses, as Strabo writes, with earth two cubits deep. In ancient times, Susa was a wealthy, extensive, and magnificent city, as its ruins indicate. Alexander found it a 50,000 talents of gold, besides jewels of an inestimable value, and an immense quantity of gold and silver vases. Here Ahafuerus kept his great feast, which lasted 11 days. Some have supposed that the present Shekerar is from its ruins. See SHUS and SHUSTER.

SURA, See ZUSAN.

SUSANYAMA, in Hindoo Mythology, a name of the ruler of the infernal regions, corresponding with the Pluto of Western heathens. Its commonest name is Tam; which see.

SUSCE, in Geography. See SCHUTZENHOFEN.

SUSCEPTOR, among the Romans, a citizen chosen by the decurions to collect the debts belonging to the public.

SUSCEPTOR is also a term used by ecclesiastical writers for sponor.

SUSCEPTOR AURARIS, in Middle Age Writers. See ARA.

SUSEAPOUR, in Geography, a town of Hindostan, in Bahar; 35 miles S.E. of Durbungah.

SUSELL, a town of the duchy of Holtstein; 8 miles E.S.E. of Eutyn.

SUSERAT, a town of Cordtian; 15 miles N. of Van.

SUSHENA, the name of an ape, who bore a part of some importance in the war of Lanksa, carried as by Rama to recover his spouse Sita from the power of her ravisher Ravanas.

SUSHUMNA, in Hindoo Mythology, a name of Soma or the moon. Sushumna is the perfumery of a ray of light proceeding from the sun; which illuminating the moon, is falsed to have produced him.

SUSIA, in Ancient Geography, a town of Asia, in Aria, a province of Persia.

SUSIANA.
SUSIANA, a province of Persia, which derived its name from Susa, its capital. It was bounded on the N. by Affrizia, on the W. by Chaldea and the Tigris, on the E. by Elamais, and on the S. by the Persian gulf. Susiana was extended by Ptolemy to the coast, so as to include the province called Elamais, which, as Ptolemy observes, lay within the bounds of this province, and was severed from it by the river Elamais.

SUSICANA, a town of India, on this side of the Ganges, and one of those which were situated on the banks of the Indus, according to Ptolemy.

SUSOONDEE, in Geography, a town of Hindooistan, in Oude; 4 miles N.E. of Gazipour.

SUSOUNDAR, a town of Hindooistan, in Bahar; 35 miles W.S.W. of Arrah. N. lat. 25° 22'. E. long. 84° 15'.

SUSPENSE, Suspensio, in Common Law, denotes a temporary stop or cessation of a man's right for a time. As, when the rent, or other profits of land, by reason of the unity of possession of the rent, and the land out of which it issues, is not in esse for a certain time, but tum dormit, or remains asleep; but so as it may be revived or awaken. By which Suspension differs from extinction, where the right dies for ever.

SUSPENSION, Suspensio, the act of preventing the effect or course of any thing for a certain time.

In rhetoric, suspension is a keeping the hearer attentive and doubtful, in expectation of what the speaker will conclude with.

The principal point urged in the philosophy of the Sceptics and Pyrrhonians, is a suspension of mind.

Suspension, in Law, denotes a centurie inflicted, by way of punishment, on an ecclesiastic, for some considerable fault.

It is of two kinds, vis. ab officio, and a beneficio. The first is that by which a minister is, for a time, forbidden to execute the office of a minister. The second is when a minister is, for a time, deprived of the profits of his benefice.

Where the fault is more notorious, the two kinds of suspension are sometimes joined; and the person both suspended ab officio and a beneficio.

The penalty for a clergyman officiating after suspension, if he shall perfide therein after a reprieve from the bishop, is (by the ancient canon law), that he shall be excommunicated in all manner of ways, and every person who communicates with him shall be excommunicated also.

There is another sort of suspension, which extended also to the laity; suspension ab inregra ecclesiae, or from hearing of divine service, and receiving the holy sacrament, which may be, therefore, called a temporary excommunication.

It is an undoubted rule in admiralty and ecclesiastical courts, that a person suspended for a trumped up offence, of which he is afterwards acquitted in a proper court, is entitled to all the intermediate profits. Thus, in case of capture of prize at sea, the officer in arrest being actually on board, and afterwards duly acquitted, or relitig to his station, shall have the prize-money. So in civil causes in admiralty, if a matter turns his mate, without just cause, before the mast, and he uses for wages as mate for the whole time, he may recover, though he did not perform the duty. So if a clergyman be suspended ab officio et beneficio, and, upon an appeal, be declared innocent, he will recover the profits of the living.

Suspension, in the Law of Scotland, is that form of law by which the effect of a sentence condemnatory, that has not yet received execution, is stayed or postponed till the cause be again considered. The first step towards suspension is a bill preferred to the lord ordinary on the bill. This bill, when the desire of it is granted, is a warrant for influing letters of suspension, which pafs the signet; but if the preferer of the bill shall not, within fourteen days after passing it, expedite the letters, execution may, by act of feudal 1677, proceed on the sentence. In practice, however, it is usual for the charger to put up a protestation in the minute-book for production of the suspension, which may be expedited at any time before this is done; and if the suspender shall allow the protestation to be extracted, the bill falls. Suspensions of decrees in foro cannot pass, but by the whole lords in time of lection, and by three in vacation time, but other decrees may be suspended by any one of the judges. By the late act of feudal (1875), in order to remedy the abuse of presenting a multiplicity of bills of suspension of the decrees of inferior judges, in small causes which have passed in absence, it is declared, that all bills of suspension of decrees by inferior judges, in absence of the defenders in causes under 12l. sterling value, shall be refuted and remitted to the inferior judge, if competent; the suspender, however, being heard in the inferior court, reimbursing the charges of the expenses incurred by him previous to the remit.

As suspension has the effect of staying the execution of the creditor’s legal diligence, it cannot, in the general case, pass without caution given by the suspender to pay the debt, in the event it shall be found due. When the suspender cannot, from his low or suspected circumstances, procure unquestionable security, the lords admit jurisdiction caution, i.e. such as the suspender swears is the best he can offer; but the reasons of suspension are, in that case, to be considered with particular accuracy as passing the bill. Decrees in favour of the clergy, of university, hospitals, or parish-schoolmasters, for their stipends, rents, or salaries, cannot be suspended but upon production of discharges, or on notification of the sums charged for. A charger, who thinks, himself secure without a cautioner, and wants dispatch, may, where a suspension of his diligence is fought, apply to the court to get the reasons of suspension fully discoursed on the bill.

Though he, in whose favour the decree suspended is pronounced, he always calls the charger, yet a decree may be suspended before a charge be given on it. Nor is suspension competent even where there is no decree, for putting a stop to any illegall act whatsoever; thus, a building, or the exercice of a power which one assumes unwarrantably, is a proper subject of suspension. Letters of suspension are considered merely as a prohibited diligence; so that the suspender, if he would turn provoker, must bring an action of reduction. If, upon discoursing the letters of suspension, the reasons shall be sustained, a decree is pronounced, suspending the letters of diligence on which the charge was given simpliciter; which is called a decree of suspension; and takes off the effect of the decree suspended. If the reasons of suspension be repelled, the court find the letters of diligence orderly proceed, i.e. regularly carried on; and they ordain them to be put to farther execution.

Suspension, in Mechanics. Points of suspension in a balance, are those points in the axis or beam in which the weights are applied, or from which they are suspended.

Suspension, in Music. Every forced of a chord to a given base, which is continued to another base, is a suspension. If, for instance, after the common chord of the key-note C has been played to the first note of a passage, if the base moves to G, the fifth of the key, and the chord of C; or any part of it, is continued to G a few instants before
before the chord of $G$ is struck, it is a suspenison. There are certain suspensions which are figured, and belong to the fundamental harmony. When they are discomposed, they are always chords by supposition; which fee. Other suspensions are notes of taste; but of whatever kind they may be, they should always be subjected to the three following rules.

1. A suspenison or binding note should always occupy the accented part of a bar.

2. A suspenison note should always be resolved diatonically, either in ascending or descending; that is to say, each part suspended should not rise or fall more than one degree, to arrive at the natural found which the ear expects, and which belongs to the base to which the note is suspended.

3. All suspensions expressed by figures ought to be resolved by descending, except the sharp 7th of the key, which the French term la note fênsible, and which is resolved by ascending.

With these precautions, there is no suspension that may not be practised with success; as the ear, prepared by the base for the motion of the parts, predicts what is coming. But the use of these suspensions, and distributing them with effect in the melody and the harmony, depends on good taste.

**Suspension of Arms, in War.** is a short truce which the contending parties agree on, for the burial of their dead, the waiting for succours, or the orders of their masters, &c.

**Suspensorium Ligamentum Hepatis, in Anatomy.** See Ligamentum.

**Suspensorius Oculi, a muscle surrounding the optic nerve in animals.** See Mammalia.

**Suspensory, in Surgery, a bandage to keep up the scrotum.**

**Suspental, a spring of water, passing under-ground towards a conduit or cistern.**—Allo, a breathing-hole, or vent indicated.

**Susquehana, in Geography, a large river of Chesaapeake bay, in the Atlantic ocean, rises in the state of New York by a great number of branches that spread from east to west in the extreme points, over a tract of country of about 160 miles. The most norther point from which any of these streams run south is within 8° of 43° of N. latitude. These numerous streams are collected by two large branches, viz. the Troga, and the east branch, or proper Susquehanna, which takes its name at the outlet of Otgo lake, at the village of Cooperstown. From this place it runs south to Delaware county, then turns south-west, and forms the boundary of Otgo and Delaware counties; runs across the south-east angle of Chemango, the east end of Broome county, into Pennsylvania, whence it turns west, north-west, and west, across Broome, and the south-east angle of Tioga county, again into Pennsylvania, about three miles before it meets the great western branch at Tioga Point. Its whole course, which is very devous, and abounding with small turns, may be near 145 miles within the state of New York. Its navigation is favourable for export trade, and immense quantities of timber, in all the various forms of boards, scantlings, shingles, &c. &c. deflected by this river to Baltimore, on an arm of the Chesaapeake. This large river has many rapids; and after running across the state of Pennsylvania, it enters Chesaapeake bay in the north-east corner of the state of Maryland, 69 miles in a right line about N.E. from the city of Washington.

**Sus, a town of Switzerland, in the Lower Engadine; 9 miles N.N.E. of Zuèz.**

**Susac, a town of France, in the department of the Upper Vienne; 15 miles S.E. of Limoges.**

**Sussex, the north-westernmost county of New Jersey, in the United States of America.** This county is mountainous and healthy; it has several iron-mines and works for the manufacture of bar and pig-iron. Its crops of wheat are excellent, and it abounds with herds of cattle. The produce is floated down the Delaware on boats and rafts. In this county are five Presbyterian churches, two for Anabaptists, one for German Lutherans, and one for Quakers. It contains fifteen ships; the chief of which are Newport, Greenwich, Harlequin, Knowlton, and Oxford. The population is 25,549, including 478 blacks. It is bounded N.E. by the state of New York; N.W. by Delaware river, which separates it from Northampton county, in Pennsylvania; and S.E. and S. by Morris and Hudson counties. The court-house in this county is 13 miles S.W. of Hamburg.—Allo, a county of Virginia, bounded N.E. by Surrey, and S.W. by Dinwiddie. It contains 14,632 inhabitants, of whom 6,344 are slaves. Allo, a maritime county of Delaware, bounded W. and S. by the state of Maryland, N.E. by Delaware bay, E. by the Atlantic ocean, and N. by Kent county. It contains 73,674 inhabitants, of whom 4,777 are slaves. The land is generally low, sandy, and poor. The chief town is Georgetown.

**Suffolk, one of the southern counties of England, is bounded on the west by Hampshire, on the north by Surrey, on the east and north-east by Kent, and on the south by the British Channel. The superficial area of the district has been computed at 933,560 acres; its length 76 miles, and its medium breadth nearly 20; making it a square in proportion to its breadth, and not varying at any point it reaches the boundary of Kent, where it is constricted to an obtuse point.

**Historical Events.**—Suffolk, and the adjoining counties of Hants and Surrey, were by the Romans denominated Belse, from the circumstance of their being inhabited by a people so called. These were afterwards joined by the Regni, who settled in the same district antecedent to the invasion of England by Julius Caesar. After that event, during the Roman dominion of Britain, there were four large flatboats or towns in Suffolk, which included the minor tribes of the Bibraci and the Rheni. Under the Britons, Suffolk formed a part of the Suth-Saxena-rice, as already mentioned in Surrey; and by a similar modulation, has been reduced to its present form. Like the other counties of England, Suffolk was, at the Norman invasion, divided into lordships, and assigned to some of the followers of king William. At that period the title of earl of Suffolk was given to one of these, and the title continued till 1801, when it became extinct: it was then constituted a dukedom, and given to Augustus Frederic, sixth son of his majesty.

**General Aspects, Soil, and Climate.**—The aspect of Suffolk is varied in a pleasing manner, by the inequalities of the downs, with the intervening vallies, through which the many little streams of the county pursue their respective courses to the sea. The wooded scenery which it presents, and the pasture-land with which it is contrasted, gives to the county in general a rural and a rich diversity of appearance.

The soil may be classed under the usual divisions of clay, sand, loam, and gravel. The first is the general soil of the South Down hills; the second, of the wooded district, termed the Weald; the third principally occupies the north part of the county; the fourth is found on the north side of the hills; and the last lies between the rich loam of the coast and the chalk.

The climate upon the downs, fronting the south-west, is bleak, being exposed to violent winds, which are imper-
nated with saline particles, occasioned by the spray driving against the beach. In the western part of the maritime district, the climate is warm, and highly favourable to the purposes of vegetation; and in that division called the Weald, the circulation of air is impeded, and the climate is cold and damp.

Mineralogy.—The Sussex minerals consist principally of lime-fence, which is found in the eastern parts of the Weald, of every species; marble, which is equal to that of its beauty and quality; iron-fence and ore, fuller's-earth, red ochre, chalk, and marl. The Sullfris or Pettalls marble was formerly much used in ecclesiastical architecture, and in monumental sculpture. It is now in much requite for ornamental chimneys-pieces. The stratum lies from ten to twenty feet beneath the surface, and is about nine or ten inches in thickness.

Rivers.—The waters of this county are insignificant streams, when compared with those of other English provinces. One of the principal is the Arun, which Harrison, in his "Description of Britain," entitles "a goodly water." It rises from two different heads in the northern part of Sussex, and falls into the sea at Little Hampton. This stream is noted for its mullets, trout, and eels. The other rivers of the county are the Adur, the Ouse, and the Rother, all of which run into the British Channel.

Leaves, Size of Farms, etc.—Leaves, in Sussex, are in general granted for seven, fourteen, and twenty-one years; but sometimes there are none allowed, and the tenant is entirely dependant on the honour or caprice of the landlord. Farms differ in extent according to their situation; those on the dry soils being more superior to the damp ones. The latter seldom exceed 200l. per annum, and even rarely that, but are usually about half that sum. The former average 350l., and in the vicinity of Lewes extend beyond it.

Rent varies with the quality of the land, and is from 7s. to 26s. per acre.

Agriculture.—The proportion between pasture and arable land varies in different parts of this county. In the Weald, one-third is pasture, one-third arable, and one-third wood and wattle. On the south side of the downs, the arable exceeds the pasture in the proportion of thirty to one. The rotation of crops in Sussex entirely depends upon the district in which they are grown. Some instances have occurred on very rich land, where wheat has been repeated four or five years in succession, and the product amounted to four or five quarters per acre. The crops commonly raised in Sussex are wheat, oats, clover, turnip, peas, barley, and tares. This county is particularly celebrated for its breed of sheep, fed on the South Downs: they require but a very slight quantity of food for their subsistence, and the quality of their fleeces is peculiarly sweet and tender.

See Sheep.

Forrest, Woods, and Plantations.—Sussex, like the adjoining county of Surrey, was at one period nearly covered with an extensive forest; and the quantity of wood-land which at present it contains cannot be less than 170,000 or 280,000 acres. The timber is principally oak; and its quality may be ascertained by the circumstance of its being preferred to any other species of oak, for the purposes of the navy. The Weald is principally covered with timber. St. Leonard's forest consists of about 10,000 acres of land, and Ashdown forest of at least 18,000 more.

Wolfe Lands.—The tracts of land which come under this denomination are very considerable. They chiefly occupy the northern side of the county, and are estimated at about 1,100,000 acres; yet they are everywhere intersected with turnpike-roads, and are not more than 45 miles distant from London.

Roads and Canals.—The turnpike-roads of this county are in general good, being composed of whin-fence and Kentish rag; and where these have not been used, the roads are found to be inferior, as in some of the eastern parts, where they are narrow and sandy.

There are no canals in Sussex, but the river Arun has been made navigable from the sea to its junction with the New Cut, a distance upwards of 17 miles; and from thence a company of merchants have extended it to Newbridge. A similar process has also been taken with the Rother, a branch of the former river, which constitutes part of a grand plan for connecting London with Sussex, by means of the junction of the Arun with the Wey at Guildford. A plan has also been proposed for cutting another canal from Newbridge on the Rother to Horsham, and thence to the iron railway at Merstham, near Reigate in Surrey.

Civil and Ecclesiastical Divisions.—Sussex is divided into six rapes, which are subdivided into 63 hundreds, and contains one capital city, 16 boroughs and market-towns, and 342 parishes. According to the parliamentary returns of 1811, the population of the county was estimated at 1,790,083, and the number of houses at 50,698. Sussex is represented in parliament by twenty-eight members; two for the county, two for the city of Chichester, two for each of its boroughs, and two for each of the four Cinque Ports that are situated within the county. Sussex is in the diocese of Chichester, and province of Canterbury.

Manufactures.—The principal manufacturer carried on in this county was the making of iron into bars; but this has decayed, on account of the great establishments in Scotland and Wales, where, by the use of pit-coal, the article is supplied at a much cheaper rate.

Antiquities.—The county of Sussex contains many Roman and some British antiquities. The Ermine-street, one of the eight British roads, led from this coast to the south-east part of Scotland. Here also was the Stan-street of the Romans, which passed from east to west of the county, with a vicinat, or branching road, towards Porchell. There are also many remains of Roman encampments in this district: these are situated in the vicinity of the downs, and overlook the Weald. Mr. Dallaway, in his "History of Western Sussex," recounts eleven of these relics of early encampment. Over the downs, and other parts of Sussex, are scattered various tumuli, or barrows, which, when opened, have been found to contain either bones, urns, or entire skeletons.

In 1717, a tessellated pavement, bath, and other antiquities, were discovered near Eastbourne. Similar remains have been found at Chichester, and at Bignor, very near the Roman road from that city; and coins of the lower empire have been dug up in several other places.—Beauties of England and Wales, vol. xiv. Sussex, by F. Shoberl, 5vo. History of Western Sussex, by the Rev. James Dallaway, M.A. Agricultural Survey of Sussex, by the Rev. A. Young.

Sussex Marble, a name given by many to a peculiar species of marble found in the county, the name of which it bears, and formerly much used in the pillars of churches, and other buildings, but now less regarded. The ground of this marble is grey, with a faint cast of green, and it is very thick-set in all parts with shells; these are chiefly of the turbinated kind, and they are generally filled with a white spar, which adds very greatly to the beauty of the stone.

Sussex Noodles, in Agriculture, a sort of tool of the terti-
SUS

flying kind, which is much employed in that district or county, and thought an implement of great power and utility in working the surface of ploughed land, and extirpating and clearing away the weedy matters that may be present upon it. It is strongly formed, in somewhat a long triangular shape, the neck part, or that to which the team or moving power is attached, being considerably drawn or lengthened out, and supplied with a wheel, by which the working of it is, in a great measure, regulated in regard to the depth it may have. It has fix or eight sharp triangular cutting flanks or hoes, as the size of it may be, fixed on strong shanks of some length, which are inserted and fastened into the strong side-pieces, and the three cross-bars or framing-pieces, by means of strong nuts, screwed firmly down upon the upper ends of the thanks. And there are two shafts or handles fixed behind for regulating the implement by.

When kept well sharpened in the hoe parts, it acts in a very ready and powerful manner, breaking down and reducing the surface parts with great effect and expedition. A representation of it may be seen in the Corrected Agricultural Report of the County, published a few years ago.

SUSITONGS, in Geography, a branch of the Sioux Indians, in North America. See Sioux.

SUSSMILCH, John Peter, in Biography, a German Lutheran divine, was born about the beginning of the last century, and applied with diligence not only to the study of history, but to that of mathematics, so that he became an expert calculator in political arithmetic. In the year 1759, he evinced his talents in this kind of science by a memoir, that was published in the Transactions of the Academy on Sciences at Berlin, on the population of the cities of London and Paris, to the latter of which he alluded, in 1750, 500,000 inhabitants. But he is principally known by a superior work, entitled "Die Gottliche, &c.," i.e. the order observed by God in the changes of the human race, demonstrated by the births, deaths, and propagation of man; a fourth edition of which, improved and corrected by J.C. Bauman, was published at Berlin in the year 1775, in 3 vols. 8vo. In this work the author first treats of the multiplication of men in general, and shews that the number of births is always almost always greater than that of the deaths: he then enumerates the obstacles to the increase of mankind; examines how many persons live on the earth, and how many it could contain; treats on the different causes of fecundity; the propagation of the two sexes, and the proportion of one to the other; of the proportion of those who die at different ages; of diseases and their proportion; of the use made of bills of mortality to determine the number of the living; and of the best method of keeping registers of the whole, illustrated with copious lists of births, deaths, and marriages, in the states of the king of Prussia, the cities of London, Vienna and Breslau, Paris and Berlin, in different years. This work has been of great service to writers on population, and is often quoted by Mr. Malthus on this subject. The Abbé Denina says, that the religious zeal of Susmilch sometimes led him to indulge a spirit of persecution; and that in the Confinitory, of which he was a counsellor, he often appeared forward and ambitious. He died in 1767, at the age of 61 years. Gen. Biog.

SUSTENAL, in Geography, a town of Prussia, in the province of Ermeland; 15 miles S.W. of Heilberg.

SUSTERT. See Stutter.

SUSTEREN, a town of France, in the department of the Roer; 5 miles S.S.W. of Ruremond.

SUSTERS, a small island in the North Sea, on the coast of Norway; 13 miles S.E. of Tonberg.

SUSTENENTE, a town of Italy, in the department of the Misson; 11 miles S.E. of Mantua.

SUSU, a town of Asia, in the province of Natolia; 16 miles S.W. of Iffartisch.

SUSUGHERLIK, a town of Asia, in Natolia; 44 miles S.W. of Burfa.

SUSUN, a town of Arabia, in the province of Hedeja; 20 miles N.W. of Karac.

SUSZA, a town of Russia; 42 miles S. of Polotsk.

SUTAGOTCHY, a town of Bengal; 8 miles N. of Hoopyly.

SUTALARY, a town of Hindoostan, in Bengal; 65 miles S. of Dacca. N. lat. 23° 40'. E. long. 95° 15'.

SUTARBOY, a town of Bengal; 8 miles S.E. of Rogonatpour.

SUTCHAVA. See Suczava.

SUTCHUTZ. See Schitterhofen.

SUTE, SUTIB, or Suits. See Suit.

SUTEMA, or Sutamon, in Geography, a town of Africa, in the kingdom of Krimen.

SUTER POINT, a cape of England, on the coast of Durham. N. lat. 55° 2'.

SUTERRA, a town of Sicily, in the valley of Mazzar; 16 miles N.E. of Girgenti.

SUTHAUSEN, a town of Welfphalia, in the bishopric of Osnabruck; 2 miles S.S.W. of Osnabruck.

SUTH-DURE, in Ancient Customs, denotes the south door of a church, mentioned in old authors as the usual place where canonical purgation was performed. This is, with a few exceptions, almost always proved by sufficient evidence, the party accused came to the south door of the church; and then, in the presence of the people, made oaths that he was innocent.

This was called judicium Dei. And it is for this reason that large porches were anciently built at the south doors of churches.

SUTHERLAND CREEK, in Geography, a creek of Upper Canada, which runs into lake St. Francis, between Pointe au Bodet, and Pointe Moutilie, in the township of Lancaster.

SUTHERLAND POINT, the S. point of entrance into Botany Bay, so called from — Sutherland, one of Capt. Cook's seamen, who was buried there in the year 1770.

SUTHERLANDIA, in Botany, so named by Mr. Brown, in Ait. Hort. Kew. v. 4. 327, (in memory of Mr. James Sutherland, who published in 1683 an extra catalogue of the phytic-garden at Edinburgh,) is found solely on the Colutus fruticos, Linne. Sp. Pl. 1045. Cor. Mag. t. 181, with the following.

E. Ch. Calyx with five teeth. Standard without calli-
ties at the base, folded back at the sides, shorter than the long keel. Stigma terminal. Style bearded longitudinally at the back; transverse in front at the summit. Legum inflated, membranous.

We always differ with reluctance from our able and judicious friend, and might perhaps admit his present genus, did not Swainson (see that article) appear, in our opinion, to invalidate it. See Colula, n. 4. and n. 6.

SUTHERLANDSHIRE, in Geography, one of the most northerly counties of Scotland, extends the whole breadth of the island; and is bounded on the N.E. by Caithness; on the E. and S.E. by the German ocean, and the Frith of Dornoch; on the S. and S.W. by Ralston; on the W. by the Atlantic ocean; and on the N. by the
great North fes. This county is one of the largest in Scotland, and contains about 2310 square miles, or 1,478,400 English acres; yet, in consequence of its vast mountainous districts, its value is inconceivable. The whole extent of Sutherlandshire is about 80 miles in length, and 40 in breadth, and its population, in 1811, amounted to 25,629 inhabitants, and 4882 houses.

General Aspects of the Country. The surface of Sutherlandshire is mountainous and rocky, and presents a series of vast hills towering above each other: some of these appear clothed with heath, and as they descend, become gradually covered with verdure. Amidst this rude magnificence of nature are many valleys, each of which contains a stream, and not unfrequently a lake of considerable extent; the scenery round which, during the summer, is extremely interesting. Upon the coast are many arable fields; but the surface, though in a less degree, partakes of the rugged appearance of the interior of the country. The chains of mountains diverge like rays from the centre of this county towards the east, west, and the northern seas; forming between the mountains long and narrow glens, or straths, which constitute separate districts, sometimes 40 miles in length. The inhabitants at each extremity of these glens, have a much more ready communication with each other, than with those who only dwell at the distance of eight or ten miles in the next valley.

Mineralogy. Sutherlandshire has in many parts large quantities of free-flone, lime-flone, and slate. The lime-flone, in some places, assumes the form of marble, particularly near the coast. In the mountains, on the well-coafted, traces of ancient iron-mines are yet visible; and as the county was at one period an extensive forest, charcoal was readily procured. Some years since, a large piece of forged iron was discovered in these mountains, of a circular form, and from seventeen to twenty pounds in weight. Rock-crystals and pebbles are found in many parts; and beautiful garnets on the coast in the parish of Tongue. There are also several veins of coal, but the quality is too small for working, and the quality is far from being good. Native gold, is often found, especially near the base of the mountains; and lead-ore, veined with silver, is also found. The river Clay is the mother of these minerals, and in a few years, a mine will be established, to work the lead and silver ores. In the parish of Reelig, there is a mine of lead, which is worked, and the products conveyed by boats to different parts of the country. The rocks along the coast are hallowed into caves, or formed into arches or pillars, some of which run so regular as to appear to be the work of art. One of these, the "Great Cave of Fradigill," extends more than half a mile under ground. It is about fifty feet high, and twenty feet wide at the entrance, and grows narrow by degrees; its sides are beautifully variegated with colours that blend and melt into each other. Numbers of seals resort to this cave.

Climate. The climate of Sutherlandshire varies, according to the different districts into which it is clasped. These are the eastern, upon the German ocean; the western, upon the Atlantic ocean; and the central, or middle districts. The air in the eastern district is sometimes keen and penetrating, but is on the whole healthful and salubrious; and the western coast, from the activity of its hills, attracts the clouds; by this means, heavy rains and mists settle upon it, so as to produce a damp and wet climate.

Soil. The soil of the long valleys between the mountains is a sharp loam, capable of every improvement, if it were cleared of the great lumps of fliche which are found in it. With the exception of those farms converted into town or village, the arable land is in the proportion of one to four acres. The flat of the roads is very bad, from the little attention that is paid to them. The western coast of Sutherland is wild, rocky, and mountainous; and a confiderable part of it is an assemblage of rugged mountains, piled on each other. There are many goats in this part of the county; and in consequence of the great elevation of the hills on which they feed, the clouds from the Atlantic are strongly attracted as to occasion a very wet climate. In the southern district, which runs to the easterly of Sutherlandshire, considerable quantities of grain are raised, and black cattle are reared for sale. Some linen-narms is also spun for the manufacturers of Aberdeen, and other places. The other divisions of Sutherlandshire differ but little in their agricultural productions; peas are in general much cultivated, and a species of barley denominated bear.

Antiquities. Over the whole of the country are to be found vestiges of those ancient buildings denominated Pits; and in various parts are also to be seen remains of fortifications of different sorts. Some of them are old towers and others confit of large stones, which appear to have been intended as places of concealment for confiderable bodies of men and cattle. On the east coast, on the south side of Loch Broom, there is a hill called Craig Bar, fortified with a ditch of circumvallation. It is a steep and rocky precipice, every way inaccessible, but by a narrow neck of land between it and an adjacent hill; it contains in its whole area about eight acres. In many quarters cairns are found, which are considered as monuments erected to the glory of the heroes who fell in battle; and many spots are pointed out, in which the rival clans are supposed to have contended with each other. In the parish of Afflin, in the isle of Oldney, is a considerable cairn, in which is a stone hollowed, having a cover alof fliche. The hollowed fliche once contained a rounded one of varied colours, for which a great veneration was entertained; it was supposed to have been an object of Scandinavian idolatry. In the parish of Durness, are the remains of the tower called Dun Dornadilla. That portion of the wall which is now standing, is 18 feet at the highest part. The area appears to have been surrounded with two concentric walls; and a large triangular fliche covers the door-way as a lintel. The opposite side has been destroyed. At Milnes, in the parish of Tongue, are the remains of an ancient building; but so ruinous, and so covered with earth, that its original form cannot be traced; it is called the Yellow Heap, and is supposed to have been erected by Dornadilla, king of Scots; two skeletons were found buried near it, one of which measured seven feet in length. Two other antiquities remain to be noticed: the one consists of several heaps of fitches; and ruins of circular buildings, erected on a rising ground near the sea; and the other is Dunrabin castle, the seat of the ancient earls of Sutherland, founded by Robert, the second earl, in the year 1100.—Beauties of Scotland, by R. Forsyth. Statistical Account of Scotland.

SUTHALLI, a town of Abacish, on the Black sea; 20 miles S.W. of Mamak. N. lat. 43° 20', E. long. 48° 4 K. SUTLER.
SUT

SUTLER, in Military Language, denotes one who follows the army, and furnishes provisions for the troops. The sutlers pitch their tents and build their huts in the rear of each regiment, and about head-quarters.

SUTO, in Geography, a town of Benguela, near Cape Ledo.

SUTORS, two capes or promontories of Scotland, at the entrance of the bay of Cromarty, confiderably above the level of the sea; the one on the north, the other on the south side of the mouth, which is about 14 mile broad.

SUTRAPARAH, a town of Hindoostan, in Guzerat: 18 miles N.N.W. of Puttan Sumnaut.

SUTRI, a town of Italy, in the Patrimonio, the see of a bishop, united to Nepi; 22 miles N.W. of Rome. N. lat. 42° 15'; E. long. 12° 15'.

SUTTEE, or SATI, a word in the Sanscrit, or sacred language of the Hindoos, meaning pure, and hence extensively applied to their female deities, and to acts of purification, especially to that pre-eminent species, the self-immolation of the widow on the funeral pile of her deceased husband. This horrid sacrifice is commonly written Suttee by the English; but Sati (under which word the following account was accidentally omitted) is the correct mode of spelling it, according to the orthodoxographical system of the late sir W. Jones.

From some recent publications and speeches, we may be led to infer that the sacrifice in question is one of frequent occurrence in India; but this is not the case: it is indeed very rarely seen, as any of our readers may be convinced by enquiring of their friends or acquaintance returned from that country, if they ever witnessed it. Nine in ten, and perhaps a much greater proportion, even of those who have passed many years there, will reply in the negative. In the whole of India, under the British government, this suicide is of course never permitted; and under native governments, it is said to be practised less frequently than formerly. As it is the greatest victory that pietiecraft has achieved over the natural feelings and instincts of mankind, we may expect to find it oftenest at the chief feast of Brahmanical superition. And Poona being the only capital of a Brahman government, we have good reason to believe that it occurs more frequently at that city than in any other throughout India.

The Hindoos have a mystical reverence for the confluence of rivers. See Indus.

On the interesting subject of this article, we are induced to make an extract of some length from the Hindoo Pantheon.

"Human victims," says the author, "were formerly immolated at the flurine of offended or avenging deities, as I have had occasion to notice in another place; but the practice is now, perhaps, entirely discontinued. In the countries under our government, it is of course, in that instance, as well as in every other of an atrocious nature, whether voluntary or otherwise. But a few years have elapsed since a widow in Bombay wanted to become Sati, that is to burn herself; which being of course prevented, she applied to the governor, and on refusal, crossed the harbour to the Mahratta shore, and there received her crown of martyrdom.

"Prodigality, or carelessness of life, has on another occasion been remarked as a conspicuous trait in the Hindoo character; hence has arisen such an army of martyrs, as no other religion, perhaps, can outnumber; as well as meritorious suffering for religion's sake. Suicide is in some cafes legal, and even commendable: that for instance of the Sati, or self-immolated widow, the only one that came under my notice, and to which sacrifice I have attended several victims. This triumph of pietiecraft, the greatest perhaps it has in boast, occurs at Poona, in ordinary and quiet periods, usually about twelve times, on an average of as many years. I was lately a whole year at Poona, and I knew of its occurrence only six times; but it was a tumultuous and revolutionery period, and people were of course put out of their usual and ordinary routine of thought and deed. As this terrible ceremony is generally performed at Poona, at the junction of the Muta and Mula rivers, a quart of a mile from the skirts of the city, at which junction, these called Sangam, the English residency is situated; and any habituation was as near as possible to the river, on the bank opposite to the spot of sacrifice, and not more distant than two hundred yards, I most likely knew of all that occurred; and, with the exception of one that took place at midnight, attended them all.

"As this affecting scene has been so often described, I shall not here enter into any detail of particulars; it may be observed, however, that on no two occasions were the ceremonies, which sometimes are very numerous and striking, exactly alike. They seemed prolonged or abridged, in a degree corresponding to the fortitude or timidity of the victim.

"The first that I attended was a young and interesting woman, about twenty-five years of age. From the time of her first coming on horsecarriage to the river-side, attended by mufic, her friends, Brahmanas, and spectators, to the period of her lighting the pile, two hours elapsed; so evinced great fortitude. On another occasion, an eldery, sickly, frightened woman was hurried into the pile in a quarter of an hour.

"Of the first of these I took particular note. Soon after I arrived at the pile, the rescuing, the law, and beckoned me to approach her. All persons immediately made way, and I was led by a Brahman close up to her, when I made an obeisance, which she returned, looking full in my face, and proceeded to present me with something that she held in her hand. A Brahman flapped her, and desired me to hold my hand out, that what she was about to give me might be dropped into it; to avoid pollution, I suppoze, by touching any thing while in contact with an impure person. She accordingly held her hand over mine, and dropped a pomgranate, which I received in silence, and reverently received. I was sorry that it was not some ornament, or something of an imperishable nature, that I might have preferred it. My wife, who was in the house on the other side of the river, observing the ceremonies through a glafs, was also dill pointed, and was of course curious to know what was the article presented in fo interrelling a manner at such a solemn time.

"After the Sati was seated in the hut of straw built out the pile, with the corpse of her husband beside her, and just before the fire was applied, a venerable Brahman took me by the hand, and led me close to the straw, through which he made an opening, and desired me to observe her, which I did attentively. She had a lighted wick in each hand, and seemed composed. I kept sight of her through the whole of her agony; as, until forced to retire from the intensity of the heat, which I did not, however, until a good deal scorched, I was within five feet of the pile.

"When the victim is a person of consequence, the sikhs are, it is said, collected and thrown into the Ganges. I do not imagine that such attention is paid to persons of inferior condition, but I may be mistaken. Of my interesting victim I was deferous to obtain some of the ashes, to preserve in lockets, &c. but was not able to get any. A military
SUTTEE.

guard is generally placed over the spot of sacrifice, and my application was refused by an attendant Brahman; who, after some solicitation, told me, that he could not imagine of what utility the ashes of the Sati could be to me, unless for the purposes of forcery. A firm belief in the power of witchcraft and necromancy exists very extensively among all ranks and religions in India; and some inferences of its effects, both of a ridiculous and terrible nature, have come within my knowledge." Hind. Pan. p. 355.

On this subject, the following passage occurs in another place. "In the neighbourhood of temples, it is not unusual to see a flat stone emblazoned or engraved with two feet: several are about the temples at the Sangam near Poona; and I was told by a Brahman that they are in remembrance, and in honour of widows who have become Sati there, being their last earthly or human impression carved on the stone which served to rep by up to the pile of their husbands. At this affecting sacrifice I have observed a flat stone placed for this purpose, and that the family of the victim, and the attendant Brahman, received their bierlings and thatms while the flood on it. Having quitted this stone, she is no longer human; she commences a participation of the beatitude to the fruition of which she is hastening. It chills me to reflect, that I have for several minutes been close to a beautiful young creature in this awful situation, even to the moment of the flames reaching her, when her soul could scarcely be thought more in this than in another world. What my feelings may have been, when witnessing this tremendous scene, I cannot say or recollect. But I know that I could not then, however much it would have relieved me, shed a tear; although, when reflecting on it, it cannot always be withheld." Ib. p. 435.

The Hindoos, in common with several other ancient people, a veneration for divine impreions of feet. These are called Srijapa; which fee.

Although most of the fanguinary atrocities and fooletries practised by enthuasietic individuals among the Hindoos, are not only discomteeeed but condemned by the Brahmas, this of the Sati is certainly sanctioned by their preference; but they deny its being promoted by their prayers. The Sacred books only are said by them to be directing the people to immediately await the human soul on its purification by the proceSs of Sati. This benefit is also extended to the husband and family of the purified widow. The latter are exalted in the estimation of their neighbours, and probably often find their worldly circumstances amended by it.

This sacrifice, viewed in its variety of bearings on human action and fortitude, is one of the most extraordinary offered to our contemplation, exceed ed or equalled only by that of infanticide, found to be so prevalent in the same quarter of the world. (See Infanticides.) Referring to this under our consideration, we are induced to extend this article by the insertion of some particulars of the most authentic kind, taken from Mr. Colebrooke's paper in the fourth volume of the Asiatic Researches, entitled "The Duties of a faithful Hindoo Widow."

After noticing the great want of judgment in several late compilations in the slection of their authorities, and the consequent perpetuation of error; and the ncecessity of, therefore, reverting on every topic to original authorities for the purpose of correcting the errors or of verifying the facts already published, he proceeds to the selection from the Vedas, or Puranas, or commentaries, fundry texts and expositions, connected with the immolation of the Hindoo widow.

"Having first bathed, the widow, dressed in two clean garments, and holding some kusa grass, 6ps water from the palm of her hand. Bearing in her hand kusa and tala, she looks towards the east or north while the Brahman utter the mystic word O'm. (See O'm.) Bowing to Narayana, he next declares: on this month, &c. (describing the time) I (naming herself and family), that I may meet Arundhati and reside in Sverga; that the years of my stay may be numerous as the hairs on the human body; that I may enjoy with my husband the felicity of heaven, and sanctify my national and maternal progeny. May my husband's family; that lauded by the Upasanas, I may be happy through the reigns of fourteen Indras; that expiration be made for my husband's offences, whether he have killed a Brahman, broken the ties of gratitude, or murdered his friend, that I ascend my husband's funeral pile:—I call on you, ye guardians of the eight regions of the world, fun and moon! Air, fire, ether, earth and water! My own soul! Yama! Day, night, and twilight! And thou, conscience, bear witness: I follow my husband's corpse on the funeral pile."

This declaration is called Sankalpa. Of the mythological perons, &c. mentioned in it, some account will be found under our articles Sverga, Upana, and Yama. Sanctifying her own and her husband's ancestors is done usually by the ceremony called Sradha; see that article. Arundhati was the wife of the sage Valisuta.

The ritual quoted above is of the first authority. It shews that there are different forms and ceremonies observed on this occasion. The widow is made to sit by the husband's corpse; and the following text points out the method. "When the corpse is about to be consumed in the Sathotaja, the faithful wife, who fixed without, rushes on the fire." The Sathotaja is said to mean the cabin of straw or leaves, that is usually erected over and round the pile, in which the living and the dead are placed; but it would seem rather to describe the pit used in another description of Sati. On this occasion, a pit about ten feet long, six feet deep, and nearly as wide, is filled with flames, before which a cloth is loofily fupended. The body is placed in the pit, and the victim throws herself headlong against the cloth and into the pit. This is by no means in common a process as ascending the pile, and the gradual consummation of the dead and living.

In the latter mode, having repeated the Sankalpa, she walks thrice round the pile: and the Brahman utters the following texts, called Mantra, from the Rigveda, and a Purana. See Mantra, Veda, and Purana.

"O'm! Let these women, not to be widowed, good wives, adorned with collyrium, confine themselves to the fire. Immortal, not childless, nor husbandless, excellent; let them pass into the fire, whose original element is water."

"O'm! Let these wives, pure, beautiful, commit themselves to the fire with their husband's corpse."

It is said in the Sankalpa above quoted, that "though her husband had killed a Brahman, the Sati expiates his crime:" but some commentators are at the pains to shew that this expiation must refer to a crime committed in a former existence, for funeral rites are refused to the murderer of a Brahman; and although, in some other texts of sacred books, expiations for this heinous sin are mentioned, the commentators do modify them, as to deprive them of any authority on account of their Brahmanical sanctity of character. Although it is doibtful held to be the duty of a widow to devote herself, she has the alternative, on the death of her husband, to live as Brahmachari, or commit herself to the flames." The austerity of Brahmacari conveys in chastity, and in divers acts of piety and mortification: such as using no ornaments
ornaments in her drees, or costly implements at meals; eating only once a day, and then only of simple food; not sleeping on a bed, &c. The acts of piety comprise an increase in the usual duties of alms, ablation, and pilgrimage, and frequent use of the name of God in prayer.

After undertaking the duties of a Sati, that is, perfor- 

minating in her determination, for the first declaration is not 

binding, should the widow recede, she incurs the penalties of 

defilement. ‘If the woman,’” says the text, “regretting 

life, recede from the pile, she is defiled; but may be purified 

by observing the fast called Prapapata.” This is a severe 

penance: it extends to twelve days; a sparse meal once in 

each day on the first three; one in each night of the next 

three; on the succeeding three nothing may be eaten but 

what is given unsoiled; the last three are a rigid fast.

We have before observed, that in some cases suicide is 

allowed. Generally, it is certainly discouraged and for- 

bidden. The Hindu legislators have doubtless seen them- 

selves disposed to encourage the sacrifice of Sati; it is de- 

clared not to be suicide. The obsequies called Srdha, are 

forbidden for common suicides; but the Rigveda expressly 

declares, that “the loyal wife who burns herself, shall not be 

deemed a suicide. When a mourning of three days hath 

been completed, the Srdha is to be performed.” (See 

SRDHA and SUICIDE.) It may be noticed here, that the 

period of mourning is different in different tribes: its mortu- 

rafe is honourable, the longest mourning being for the lowest 

tribe.

In certain circumstances the widow is disqualified for this 

act of a Sati. “She,” says the legislator Vrihaspati, “who 

has an infant child, or is pregnant, or whose pregnancy is 

doubtful, or who is unclean, may not, O princes, ascend 

the funeral pile. So said Nareda to the mother of Sagaras.” 

(See NAREDA, SAGARAS, and VRISHAPATI.) The mother 

of an infant shall not relinquish the care of her child to 

ascend the pile; but she may, if the care of her child can 

be otherwise secured. Uncleanliness alludes to periodical 
causals, or to certain purifications after childbirth. It has 

been erroneously asserted, that a widow, pregnant at the 
time of her husband's death, may burn herself after de-

livery. This is pointedly contradicted by Hindu authorities, 
as well as by the general maxim, “what was unlawful 
or prevented in its seacon, may not afterwards be re-

fumed.”

In the event of a Brahman dying in a distant country, his 

widow is forbidden to burn herself; but with other tribes 

this proof of fidelity is not precluded by the remote decease 
of the husband. If he die within a day’s journey, and the 

widow desire to die on his pile, the corpse is to be kept till 

her arrival. Many other contingencies are noticed and pro-

duced for by the commentator; but it were superfluous to 

pursue them through all their frivolous distinctions, and 

fabulous illusions on latent difficulties.

All the ceremonies essential to this awful rite are included 
in Mr. Colebrooke’s very curious paper; and we have in 
this article given many of them. But many practices have been 
introduced, unbacked by any ritual. A widow who de-

clares her intention of burning herself is expected and re-

quired to prove her fortitude; and it is confidently said, that 

one who should recede after the commencement of the cere-

mony, would be compelled by her relations to complete the 
sacrifice. This may explain circumstances described by 

some who have witnessed the melancholy scene.

Other ceremonies noticed in such descriptions are directed 
in several rituals. The following is a translation from a work 
of authority, comprising several particulars of those cere-

monies: “Adorned with all her jewels, decked with minutum 

and other cumbuary ornaments, with the box of minum is 
hers hand, having made puja or adoration to the gods, the 

reflecting, that this life is sought; my lord and master 
to me was all;” she walks round the burning pile: the 

be Southwests on the Brahman, comforts her relations, and 
throws her friends the attentions of civility—while calling 

the fun and elements to witness, she distributes minum as 

pleasure; and having repeated the falkala, proceeds into 

the flames: there embracing the corpse, she abandons her-

self to the fire, calling Sattyal Sattyal Sattyal”

This differs in the material point from the common 

usage at Poona, where it is reasonably believed that the 
spectacle is witnessed oftener than at any other city or 

place in India. At that capital the corpse, after purifi-

cation in the river, is placed on the pile, over and round 

which a cabin or hut of straw is erected. This the widow 

enters; and after divers ceremonies, as before noticed, a 
furnished with lighted wicks. The sides of the combustible 

but are within her reach, and she is supposed to 

apply the fire. It is also applied externally; and the hy-

flanders throw on butter, wood, straw, reusious gums, &c. 

according to the circumstances of the parties. For its 

they are taught that they acquire great merit, exceeding, 
in their hyperbolical style, ten millions fold the merit of 

an AFWAMEDA, which is the sacrifice of a boar, or 

sum any other great ceremony. On one occasion, and 

other insinuations known notes that might be only 

more horrible. The merit of participation is extended to 

those who join the procession from the house of the 
deleaded; for every step they are ridiculously punished, as 

by grave authors, indulgences as for an AFWAMEDA. The 

promises afford additional grounds for the inference, that 

martyrs of this horrid superstitious have never been nume-

It is certain, and we are confirmed in our assurance by Mr. 

Colebrooke’s authority, that the sacrifice is now rare: at 

this point he reasonably appeals to the fact of few of the 

numerous British residents having witnessed or known of 

its occurrence. Had they ever been frequent, supersti-

tion would hardly have promised its indulgences to spe-

cators.

SUTTIKO, or SEITIKO, in Geography, a town of 

Africa, in the kingdom of Wooly.

SUTTLE WEIGHT, in Commercial, the weight so called 

when trett is allowed. See TRET.

SUTTON, in Geography, a township of America, is 
the State of New Hampshire, and county of Hillborough, 
first called Perrytown, incorporated in 1748, and con-

taining 1328 inhabitants. Alfo, a township in Worces-
ter county, Massachusetts, 46 miles W.S.W. of Boston, 
incorporated in 1718, and containing 2660 inhabitants. 
The cavern called "Purgatory" is a natural curiously 

situated in the south-eastern part of the town. In this 
township there are several mills and manufactories of paper, 
pot-ash, nails, &c.

Sutton’s Quadrant. See QUADRANT.

SUTTON-COLDFIELD, in Geography, a town 
situated in the division of Birmingham, hundred of Ham-

ingford, and county of Warwick, England; it lies near 

the north-west border of the county, adjoining Stafford-
shire, and is placed upon a bleak and barren soil. In the 
time of Henry I., the lordship of Sutton was pref- 

ered to Roger, earl of Warwick, wif a yearly rent refer- 
ted to the crown: in the reign of Edward I., a succeeding 

earl obtained the grant of a fair and market. In the 
time of Henry VII. these were forfaken, and the town 

nearly deferte; when John Vefey, bishop of Exeter, who 
in Henry VIII.'s time had acquired allience, proceed for
for Sutton a charter of incorporation, erected a moot-ball and market-place, founded and endowed a free-school, and by other benefactions greatly improved the town and church of his birth-place. Sutton-Coldfield contains many respectable houses; and its church, consisting of a nave, chancel, and two side-aisles, was built by bishop Veysey, in the latter part of the reign of Henry VIII. The nave, however, was taken down and rebuilt in its present form about the middle of last century. Sutton-Coldfield has a separate jurisdiction, and its municipal government consists of a warden, twenty-four aldermen, a town-clerk, sheriff, and other officers: the warden for the time being is also the coroner. The grammar-school, founded by bishop Veysey, is conducted by trustees; but the gift of the mastership is in the corporation. The present school-house was built in 1728.

Sutton is endowed with a weekly market on Monday, and two annual fairs. Its population, in 1811, amounted to 2059 inhabitants, with 639 houses. The Coldfield, from which this place derives its name, lies to the west of the town; it is a bleak and cheerless tract, supposed to contain 14,000 acres, part of which is in the county of Stafford. Sutton park lies to the north-west of the town, and consists of 3500 acres, which were once granted by bishop Veysey, as a common palfreyage for the poor of the town.—Beauties of England and Wales, vol. xlv. Warwickshire, by J. N. Brewer. Antiquities of Warwickshire, by Sir William Dugdale, folio.

SUTURE, in Anatomy, the peculiar connection by which the bones of the head are joined together. See Cranium.

SUTURE, in Surgery, is a term employed to express the method of bringing the edges of a wound together by means of a needle and ligature. Formerly, the common plan of dressing wounds with sticking-plaster received the appellation of the dry future, while the real futures were distinguished by the epithet of bloody. Of the numerous kinds of futures practiced by old surgeons, there are now only four ever employed. These are the interrupted, the quilted, and the coiled future, with another one, named epigastrium. For an account of the twisted future, see HARLE LIP; and for that of the future named gastrophore, see the article Gastrorrhaphion.

With regard to the interrupted future, it is that which is by far the most frequently made use of. The curvature of the needle employed should form the segment of a regular circle. When the needle is foreshaped as to be curved towards its point, and straight towards its eye, it is obvious that it is not advantageously constructed for passing through parts with facility. It should be double-edged to the extent of one-third of its length from the point, and its breadth part should be somewhat broader than the ligature, in order that the latter may traverse the wound with the utmost ease.

In the case of a recent wound, when the bleeding has been suppressed, and all extraneous substances have been removed, the surgeon is to place the limb or part in such a posture, as shall enable him to bring the edges of the injury easily into contact with each other. If adhesive plaster be deemed insufficient of itself to maintain the part in this state, and a future be considered proper, the needle, armed with a ligature, is then to be introduced into the right lip of the wound, at a small distance from its edge, and is to be directed across the bottom of the wound, so as to come through the left lip, from within outward. The needle is now to be cut off, and the ligature tied in a bow. As many futures of this kind are to be made as the length of the wound may require; but they should always be at least an inch from each other. Strips of adhesive plaster, dressings, and a bandage, are at the same time usually applied.

The quilted future is so called from a quilt being formerly used in making it. This method of uniting wounds has been occasionally practiced when the muscles have been deeply wounded, and it was preferred, on the supposition that it produces a more perfect union; but it is the practice of a future than is done by the interrupted future. The same kind of needle is used as for this last future; but it must be armed with a double ligature. When the double ligatures have been introduced through the lips of the wound, at as many places as the length of the wound may require, their ends are to be separated, and then tied in a bow, over a piece of bougie, or quill, or any similar thing, placed along each lip of the wound.

Dinon first reprobated the adoption of this future, and it is justly rejected by almost all the moderns, so that it is unnecessary to consider any of its modifications.

In the present schools of surgery, the use of futures is not recommended as it was in former times. It is now known, that by the combined operation of position, adhesive plaster, and a bandage, almost all wounds are capable of being united as expeditiously and well as they could be, were futures to be employed. Therefore, were it only to avoid superfluous pain, we ought to reprobate the practice in general. Did futures only create a little additional pain, and no other evil, till their employment would be justifiable, if they really possessed the power of rendering union by the first intention a matter of greater certainty in only a limited proportion of cases to which they are applied. In the cure of the hare-lip, and a few wounds of the face, and, perhaps, in the treatment of large wounds penetrating the abdomen, we must admit their utility. In wounds of the lips, the incessant and unavoidable motion of these parts, and in those of the abdomen, the distension arising from the visera, and the danger of their being protruded, are reasons which explain the advantage of futures in these particular instances. But, in general, the promotion of union by the first intention cannot be set forth as a valid argument in favour of futures being commonly used. Inflammation, above a very moderate pitch, always destroys every prospect of this nature, and occasions the secretion of pus, instead of the exudation of coagulating lymph. Sutures have fallen into disrepute, principally because they tend to increase inflammation. The new wounds which they make; their irritation as extraneous bodies; the forcible manner in which they drag the living parts together; and their incapacity, in general, to accomplish any useful purpose which position, adhesive plaster, and bandages cannot effect, are strong motives for repudiating their being commonly used. In fact it often happens, when futures are practiced, that considerable inflammation of the wound is the consequence, and its swollen edges evince marks of suppuration, unless soon relieved from the irritation of the ligatures. In this case, if the surgeon be fagacious enough to cut the ligatures and remove them in time, suppuration may still be frequently avoided. Extensive erythematous redness, surrounding wounds, will often be found to originate from the irritation of futures.

Mr. Cramer’s remarks on this subject are highly worthy of universal consideration. After relating many convincing facts, he concludes with asking, what practice the partizans of futures would adopt, were they necessitated, as they frequently are, to cut the ligatures and remove them? Or, were they to find, as is often the case, that the ligatures had made their way through the lips of the wound, so as to leave them gaping? They would then never think of introducing
new futures; but would have recourse to a bandage in order to unite the wound. Sur l’Abus des Sutures, in Mem. de l’Acad. de Chirurgie, tom. iii. 420.

They who assert, that the good effect of futures is, in many cases, supported upon the solid bases of experience, ought at least to make it appear probable, that the same effect could not be produced by the combined operation of a proper posture, adhesive plaster, and the pressure of bandages.

Whoever wishes to investigate this subject further, should peruse the observations of M. Louis on the first principle of the art of uniting wounds. (Mem. de l’Acad. de Chirurgie, tom. xii. p. 118, edit. 12mo.) This eminent French surgeon, so distinguished in his profession, proved, that even the hare-lip could be united very well without the assistance of a future. Cooper’s First Lines of the Practice of Surgery, edit. 2.

SUVARTI, in Geography, a river of Darien, which runs into the Spanish Main, N. lat. 8° 37’. W. long. 77° 50’.

SUUNPOUR, a town of Bengal; 25 miles E.S.E. of Dacca. N. lat. 23° 53’. E. long. 85° 26’.

SUULPOUR, a town of Bengal; 38 miles N.N.E. of Ramgur.

SUWAIDA, a town of Arabia, in the province of Hedjaz; 50 miles N. of Medina.

SUWAIRON ZOK, ALEXANDER, Comte, in Biography, a distinguished Russian commander, descended from a Swedish family, was born in 1730, and designed by his father for the profession of the law; but he preferred a military life. He began his career as a private soldier, and rose through the subordinate ranks to that of brevet commodore of lieutenant, with which he quelled the military guards in 1754, and in the course of his advancement he obtained the command of Memel, with the rank of lieutenant-colonel. Having served his first campaign in 1759 against the king of Prussia, and having distinguished himself on various occasions, he came to Peterburg in 1763, with a recommendation from count Patin to the empress Catharine, who presented him with a colonel’s commission. In 1768 he gained considerable advantages against the Polish confederates, and was recompensed, in 1770, with the rank of major-general. In this year also he was honoured by the empress with the order of St. Alexander, and after the partition of Poland, received at Peterburg with every mark of distinction. In the Turkish war of 1773 he had many opportunities, of which he availed himself, for gaining reputation; and on the conclusion of the peace with the Turks, he was employed to check the rebellion of Pugachew in the interior of Russia; and in 1783 he compelled the Tartars to take an oath of allegiance to the empress, who then sent him the cros of Wolodimir, and nominated him general in chief. Upon the renewal of the war with Turkey in 1787, he distinguished himself in the defence of Kinburn, and at the siege of Széco-coburg, when he was surrounded by the Turks, after the victory in which he participated with him at Fockzan, and brought on the great battle against 100,000 of the Turkish troops near the river Rymnika, in September 1791, which terminated in a complete victory to the combined armies, and obtained for Suwari the title of “Rymnikski,” splendidly presents both from his own sovereignty and the empress. To him he was committed, by Potemkin, the enterprize against the strong fortresses of Haimil; when he promised to the victors, upon ordering of an assault, the plunder of the place, and directed (as it is said) that no quarter should be given. This was one of the most fan-guinary actions upon record. When the Russians, after being twice repulsed with great loss, scaled the ramparts and

burst into the fortresses, a horrible massacre ensued, 33,000 Turks were killed or desperately wounded, and about 10,000 were made prisoners after the carnage. Some persons have preferred against the general the charge of cruelty on this occasion; but whether or not he could restrain a body of victorious soldiers, exasperated by the resistance of the besieged, he acted a very disinterested part respectimg the booty, not referring for himself so much as a single lira. After the peace of 1791, which surrendered Oczakof to the Russians, Suwari received an accumulation of red honours, and was appointed commander of all the troops stationed in that part of the Russian empire, fixing his headquarters at Cheritou, where he remained nearly two years. He was employed afterwards in the disgraceful business of extirpating the liberty of Poland, and gained several victories over the patriots. In 1794 he laid siege to Propo, fortified suburb of Warsaw, and carried it by assault, with a carnage little inferior to that of Haimil. On this occasion new honours and rewards were bestowed upon him by his own sovereign, and the two other sharers of Poland, and he remained two years at Warsaw for the dissipating purpose of securing the servitude of that ill-fated country.

When the emperor Paul joined the confederacy against France in 1799, Suwari was appointed to command in the troops that co-operated with the imperialists in Italy. In the campaign during which he commanded the combined army of Russians and Austrians, the French lost all the principal towns in the north of Italy, and sutfained a defeat in the bloody battle of Novi. After that event Suwari crossed the Alps, and marching into Switzerland, drove the French from mount St. Gothard. On the defeat of another body of Russians, under general Korzakof, by Miles, Suwari, who was opposed by Moreau, was obliged to retreat towards the lake of Constance. The sitz he endured on this occasion is brought on an island; and he was ordered to return to Peterburg. The resentment which he manifested in complying with these orders offended his capricious master; and they were followed with a more positive command to the same purpose, by which he was feebly mortified. At length, however, he reached Peterburg, where he found himself fligkhted. He soon afterwards fell into a state of childildness, and died on the 18th of May, 1800, at the age of 70. Paul manifested his resentment, by refusing to his remains the ordinary military honours, and even deprived his only son of his rank of major-general. The emperor Alexander, however, repaired this injustice, by erecting his statue in the imperial gardens.

Suwari was hardy in his constitution and in his mode of living; accustoming himself, through all the gradations of his military advancement, to sleep on the ground upon hay, with a flight covering, and contenting himself with the common soldier’s fare. In winter and summer he rose at 4 o’clock; he frequently bathed the bath; and by his temperance and activity preserved the fire of youth to an advanced age. According to his mode he was pious and devout, punctually performing the offices of religion, and on Sundays and festivals reading lectures on religious subjects to his attendants. He never gave the signal of battle without making the sign of a cross, and kissing a little image of St. Nicholas, which he always carried with him. We may hence infer that his religion approached very nearly to superstition. In his purpofes he was inflexiblestrictly true to his word, and of incorruptible probity. In his speech and writing his style was laconic, interspersed with tedious expressions, and even in his dispatches and orders, with dogged veris. He was well acquainted with modern
languages, but declined political or diplomatic correspondance,
 allegation, that a pen did not suit the hand of a soldier.
His coarse manner, disregard of luxury, and contempt of
danger, rendered him the darling of his soldiers, while his
principal officers were his secret enemies, on account of the
strict duty he exacted, and the privations to which he sub-
jected them. It was one of his military maxims, that a
general should be always in the front of his army. "In
courage and activity, and rapidity," says one of his biogra-
phers, "he had no superior; but the critics in the art of
war have censured him for want of depth in his combina-
tions and skill in his manoeuvres, as well as for violating hu-
Biog.

SUYA, in Geography, a town of South America, in the
province of Quito; 12 miles S.E. of Guayaquil.

SUYAHILA, a town of Africa; 65 miles S.S.E. of
Sugarnefla.

SUZA, a city of France, in the department of the Po,
formerly capital of a marquisate, and province of Fiemont,
situated on the river Dora Riparia, in a valley to which it
affords name, at the foot of the Alps, anciently called
"Secuflum," or "Segraflum," or "Seguflina." It was the
capital of the kingdom of Cottius, and the place of his
usual residence. The possession of it has been often con-
tinned, and it has suffered much in passing from the pos-
session of different successor conquerors and proprietors.
The Goths, Lombards, and Saracens, have successively
plundered this place; but it suffered most from the capture
of Flanders by the Normans, who, in passing from Germany into
Italy, destroyed it to its foundation, and reduced it to ashes.
It anciently gave the title of marquis to the descendants of
Charlemagne, and was transferred to the dukes of Savoy
by a marriage with Adelaide, the only daughter of the last
marquis. It is now small and poor, with single walls, and
defended by a citadel with a strong garrison. It contains
three parish churches, and several religious houses. In its
vicinity is a triumphal arch, erected to the honour of
Augustus. Suza has of late experienced the vicissitudes
occasioned by the French revolution in the province of
Fiemont; 23 miles N.N.W. of Turin. N. lat. 45° 30' E. long. 7° 10'.
The marquisate of this name is about 30 miles long, and 10 broad, watered by the Dora and the
Cinflera. The principal towns are the Suza, Giavenna,
Avigliano, and Novale.

SUAZBAD, a town of Bengal; 15 miles N.E. of
Rognantpur.

SUZAO, a town of Portugal, in the province of Beira;
31 miles N.E. of Braganca Nova.

SUZARA, a town of Italy, in the department of the
Mincio; 14 miles S. of Mantua.

SUZAVIN, a town of Peru, in the province of Irak;
90 miles E. of Hamadan.

SUZAY, a town of France, in the province of
Eure; 14 miles E.N.E. of Grand Andelys.

SUZDAL, a town of Ruffia, in the government of
Vladimir, on the Nerl, the fee of a bishop. Peter I.,
after divorcing his wife, Eudoxia Fedorowenna, confined her
in the convent of St. Basil in this town; 24 miles N.E.
of Vladimir. N. lat. 56° 10'. E. long. 40° 44'.

SUSE, a town of France, in the department of the
Savoie, and chief place of a canton, in the district of Le
Mans; 9 miles S.W. of Le Mans. The place contains
1414, and the canton 8907 inhabitants, on a territory
of 170 kilometres, in 13 communes.

SUSE, a river of Switzerland, which runs into the
lake of Bienna, about a mile below the town of Bienna.

Suzza la Rouffe, a town of France, in the department of
the Drôme; 18 miles S. of Montelimart.

SWAB, a fort of mop formed of a large bunch of old
rope-yarn, and used to clean the decks and cabins of a ship.
Hence

SWABBER, the title of an inferior officer on board of a
man of war, whose office is to take care the ship be kept
neat and clean.

In order to this, he is to see her washed well once or
twice a week at least; especially about the gun-wales and
chains.

He ought also to burn pitch, or some such thing, now-
and-then between decks, to prevent infection, and to ac-
quaint the captain with fitch of the men as are nalty and
offensive.

SWABENITZ, in Geography, a town of Moravia, in
the circle of Olmutz; 17 miles S. of Olmutz.

SWABIA, or SUABIA, a circle of Germany, bounded
on the N. by the Palatinate of the Rhine and Franconia,
the E. by Bavaria, on the S. by Switzerland, the lakes of
Constance, and the Tyrol, and on the W. by France,
from which it is separated by the Rhine; about 120
miles from east to west, and 80 from north to south.
The ancient county of Swabia was rather more extensive.
The name is suppos'd to be derived from the Suevi, who first
inhabited the country between the Wefer and the Oder,
but afterwards crossed the Elbe to the Main and Danube,
and in the time of Julius Cæsar to the Neckar and the
Rhine. In the fifth century, this country was conquered
by the king of the Franks, who erected it into a dukedom,
which Charles the Great abolished, but Conrad I. reformed.
The title became hereditary about the year 1094; the
dukes of Swabia being at the same time dukes of Franconia,
but with very limited prerogatives of these dukes, many
of them became kings of Germany; the dukes became ex-
alted about the middle of the 13th century. In the middle
ages, Swabia was divided into a great number of gens, in
Latin pagi, the names of some of which are still in use.
The states of Swabia, at the diet, were divided into five
benefices, viz. 1. The ecclesiastics, or bishops and abbots
2. Temporal princes and abbots 3. Counts and barons
4. Free imperial towns. The princes summoned to the diet of the circle were, the bishop of
Constance and the duke of Wurtemberg, but the latter was
the sole director. The diets of the circle were commonly
held at Ulm, and in time of peace twice a year. Each of
the five benches had its director, but without any peculiar
prerogative above the rest of his order. The directors of
the five benches let their seals to all the reccefs, or acts of
the circle, and other dispatches. The bishop of Constance
was the perpetual director of the bench of ecclesiastical princes, as
the duke of Wurtemberg was of that of the temporal princes.
The directors of the benches of prelates and counts were
chosen only for life. Ulm, indeed, was perpetual director
of the bench of the Imperial towns; but Augsburg always
voted first. The chancery and record office belonging to
the circle were kept at Stuttgart, the residence of the
director of Wurtemberg. In the year 1581, the military
force of the empire, by a decree of the diet, was settled in
time of peace at 40,000 men, and the quota of the circle
of Swabia alone came to 1321 horps, and 2707 foot; and
in the year 1707, at the division of the 300,000 florins,
which was the sum granted for that purpose, its proportion
was rated at 31,271 florins, 58 kruots, 5 deoers. The
number of troops in this circle, constantly kept on foot,
confined of four regiments of infantry, each composed of
twelve companies, one regiment of dragoons, and one of
cuirassiers.
cui-raisers, each confiding of eight squadrons. The com-
mander of the circle was styled general field-marshall. With
repeal to religion, this circle was reckoned among the
mixed ones. Under the emperor Frederic III, the circle
of Swabia was, for the sake of the peace of Germany,
divided into four quarters. The head of the first was
the duke of Wurtemberg, of the second the margrave of
Baden, of the third the bishop of Constance and the abbot
of Kempton, and of the fourth the bishop of Augsburg.

Swabia, Austrarian, was composed of the ancient hereditary
estates of the house of Habsburg, and the remains which
had fallen to Austria, since it has been elected to the
empire. Maximilian I. was the first prince of this house
who took the name of the prince of Swabia. It paid an-
nually more than 400,000 livres to the military chief of
Austria. These estates were composed of Burgau, Nellen-
burg, the prefecturate of Swabia, Hohenberg, the Ortenau,
Brigau, and some towns and convents.

SWAD, in Agriculture and Gardening, a provincial word
signifying a pod, as of peas, beans, &c.

SWADHA, in Hindoo Mythology, is said to be a goddes-
son whose whole adventures are very poetically narrated in one
of the Puranas, or sacred romances, entitled "Brahma-Vai-
wartika." (See Purana.) She was originally a nymph of
Galaka, the paradise of Krifna. Her celestial charms excite
the ardor of the bard, Radha, who represents the Greek
Juno in her caprices, her jealousy, and sometimes in her
fury; while at others she is all tenderness and attraction.
Hurling by the goddess from the empyrean, Swadha was
confided by being given in marriage to the Dii Manes.
She is hence the goddes of funeral obsequies; conveying
to the manes the offerings of men, and rewarding the
latter for their piety to their ancestors.

The word Swadha is further used as a sort of grace or
benediction, after eating the food offered in the ceremony
of the Braga in honor of deceased ancestors. (See
Swadha.) It seems to mean enough; and to be applied
to the food of the manes, and of those who eat of the
offerings made to them. (See Lakshmi.) The word Swadha is,
however, of profound and mythical import, being some-
times used as equivalent to Maya, or illusion.

SWAFFHAM, in Geography, a large respectable market-
town in the hundred of South Greenhoe, and county of
Norfolk, England, is situated 28 miles W. from Norwich,
and 93 N.E. from London. The town is extensive; the
houses being distributed over a considerable space of
ground. Near the centre is a large open area, in which is
a pool of water. The chief public structure is the parish
church, a spacious handsome edifice, the greater part of
which appears to have been built about the time of
Henry VI. or Henry VII. It consists of a nave and two
aisles, with two transepts on the south side, one to the north,
and a lofty well-proportioned tower, surmounted by
embraced embrasures and pinnled pinnacles. The nave is
very lofty, and has twenty-six clerestory windows. Some
of the pews are curiously carved; and in the library is pre-
ferrable literature. Here are some handsome genealogies,
among which is an altar-tomb, with an effigy of Dr. John
Botwright, a native and rector of this parish, and chaplain
to king Henry VI. In ancient days, the earls of Richmond
had a priory in this town; and at the present time here is
a house of correction, or bridewell, which was erected in
the 41st of queen Elizabeth, for the hundreds of South Greenhoe,
Weyland, Grimhioe, Shropham, Giltercas, Freebridge, and
Clackeioe. Swaffham being an ancient demeine of the
crown, its inhabitants enjoy many exclusive privileges.
The population was returned to parliament in the year 1811,

as 2,350, occupying 400 houses. A weekly market on
Saturdays is well supplied with provisions; at which time
is held a great mart for butter, recently removed from Down-
ham. Here are also three annual fairs. In the year 1795,
a cross was erected on the market-hill by the late earl of
Orford. An assembly-room has been lately built on the
west side of the hill.

About five miles from Swaffham is Narborough, a small
village, but peculiarly interesting to the antiquary. John
Brane, in a manuscript history, quoted by Spelman in his
"Iceni," says, "this was a British city in the time of
Uter Pendragon, about the year 500." The name is Saxe,
and the works in the vicinity point out its antiquity. It is
supposed a small Roman station was once established here.
From this place to Ealalm-leen, a large foss and rampart
extend, by which the hundred of Clackeioe was bounded.
At the head of this foss was a lofty fortified mound, called
the burgh. In making a garden near its base, in the year
1600, several human bones and pieces of armour were

discovered.

In the contiguous parish of Narford, is Narford Hall,
the seat of Brigg Fountaine, esq., erected by Sir Andrew
Fountaine, knight of the Bath, who rendered himself so
useful in the place conspicuous, by cultivating the friendship of Pope
and other literary characters. The house was not only
a rendezvous of literary genius, but a repository for works
of art and learning. At present it displays a choice collection
of pictures, ancient painted earthenware, and a valuable
library. Among the old china are several pieces painted
by Raffaello, particularly two very large ciphers of the
form and execution, measuring three feet by eighteen inches
each.—Bromfield's History of Norfolk, vol. vi. Beauties
of England and Wales, Norfolk, vol. xi. by J. Britton,
F.S.A.

SWAGLERS, an Indian town of West Florida, near
the Apalachicola. N. lat. 31° 41'. W. long. 84°.

SWADA, in Hindoo Mythology, is the fakir or enemy,
or in more popular language, the confessor, of Parava, the
god of fire.

SWAIN. See BOATSWAIN and COCKSWAIN.

SWAIN, in Geography, a river of Prussian Lithuania,
which runs into the Ilmen; 4 miles W. of Malchins.

SWAINMOTE. See SWAINMOTE.

SWAINSON, in Botany, more correctly SWAINESON,
was so named by Mr. Salisbury, after the late Mr. Isaac
Swainson, who having derived considerable profit from the
sale of a medicine called Velno's Vegetable Syrup, believed
part of his income in the maintenance of a botanical garden
at Twickenham, to which his acquaintances, it seems, were
liberally admitted. Still it does not appear that he was
entitled to the distinquishing appellation of "a second
Clifford," nor that he was a cultivator of botanical science.
We have always gladly concurred with Mr. Salisbury in
his prudent reserve in beftowing such honorary generic
names, as well as in his attention to classical propriety in
constructing others; and we will always do so, while, with
pride, we confess the approval of a competent judge in
weeping away all that are incorrect or unmeaning.

If the present genus were to remain, Venetan's name of
Loxidium, previously printed, might be adopted, as it is
more expressive of the ambiguity of its character. We
incline, however, to the opinion of Dr. Sims, who hold
that this genus, as well as SUTHERLANDIA, (see that article)
are too nearly allied to Colutea. The reader may consult
Salib. Parad. t. 28. Curt. Mag. t. 1725; t. 792; and
Brown in Act. Hort. Kew. v. 4. 326. In the latter we
find the following.
in the jaws of the wolf-fish, or in the palates of some of the lefs known kinds.

**Swallow-Wort, Hirundinaria, or Asclepias, in Botany.** See Asclepias.

The common swallow-wort of the shops, with a white flower, called vincetoxicum and birundinaria, is denominated tame poison, because it has been deemed a powerful counter-poison. The flowers appear in June, and the seeds ripen in September. It grows naturally in the south of Spain, and Italy; and is important as an instance of such a distinction between Colutea and Sutherlandia. See those articles.

**SWALE.** East and West, in Geography, the two branches of the Medway; the East Swale branches off to the right, and runs S. of the island of Sheppey, and joins the Thames below Sheernes: the West Swale, or main stream, proceeds due N., and joins the Thames at Sheernes.

**Swale,** a river of England, in the county of York, which runs into the Oule, near Boroughbridge.

**Swale,** in *Rural Economy,* a term signifying shade.

SWALLOW, or SWALLOWS, a term applied to the operation and practice of dressing a hog for bacon, by singeing or burning the bristly hairs off by means of flar, or from other similar substances. It is a method often used in the southern districts of the kingdom.

**SWALLOW,** in Ornithology. (See HIRUNDO.) For an account of the migration of swallows, see MIGRATION.

**Swallow, Sea,** is also a name given to the *Sterna hirundo* of Linnaeus; which see. See also TERN.

**Swallow, Water, Hirundo aquatica,* a name very improperly given by Beller, and some others, to the northern columbus, commonly known by the name of the lume. See COLOMBUS TRIOLE.

**Swallow Bay,** in Geography, a bay on the north coast of Egmont island, between Hanway's Point and Swallow Point.

**Swallow Harbour,** a harbour in the frigates of Magellan, on the coast of Terra del Fuego. This harbour is well sheltered from the winds, and excellent in every respect. There are two channels into it, both narrow, but not dangerous, as the rocks are easily discovered by the weeds that grow near them. The mountains round it have a horrid appearance. S. lat. 53° 29'. W. long. 74° 35'.

**Swallow Island,* one of those called Queen Charlotte's islands, in the South Pacific ocean; about fix leagues in length. S. lat. 10° 58'. E. long. 165° 28'.

**Swallow Point,** a cape on the N. coast of the island of Egmont, in the South Pacific ocean. S. lat. 10° 42'. E. long. 165° 28'.

**Swallow-Fish,** Hirundo prisca, or, as it is called in Cornwall, the sub-prisca, a sea-fish of the trigla kind, remarkable for the size of its gill-fins; called the justiphere gurnard. See TRILOGA HIRUND.

**Swallow-Fly,** in *Natural History,* the name of the chelidonius, a fly very remarkable for its swift and long flight.

**Swallow-Stone,** Chelidonius lapidis, the name of a stone which Pliny, and many other authors, affirm to be found in the stomachs of young swallows. It is always described to be small, roundish, convex on the outside, and concave on the other, and of a brownish, yellowish, or blackish colour; this, and the figures given of it, plainly shew that it is either a small species of the lygodium, or bufonite, or else a detached piece of one of the compound ichthyopera, or; as they are vulgarly called, *fugughra.*

De Boot tells us, that he cut up several young swallows, but never found any such stones in them; and indeed it is no wonder, since they are not to be looked for there, but

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as a beacon to vessels making for the road of Surat, and to point out the anchoring place. This tower is about 30 feet high, and was erected as a monument over the grave of an English captain, named Vaux, who was buried there many years ago. Near this place lies the celebrated English traveller, Thomas Coryate, who finished his earthly perambulations here in the year 1617; 15 miles W. of Surat. N. lat. 21° 10'. E. long. 72° 32'.

SWALM, a town of France, in the department of the Roer; 4 miles N. of Ruremond.—Allo, a river of France, which runs into the Meuse, 5 miles below Ruremond.

SWAMMA, a town of Algiers; 13 miles S. of Tagadampt.

SWAMMERDAM, John, in Biography, a distinguished anatomist and naturalist, was born at Amsterdam in 1627, and designed by his father, who was an apothecary in that city, for the church; but his own inclinations were directed to physic, which became the object of his study, together with several branches of natural history, particularly entomology. At an early age he made many excursions for the purpose of enlarging his collection of winged insects. At Leyden, where he studied physic, he was distinguished by his skill and affability in anatomical experiments and the art of making preparations. At Paris he was intimate with Nicholas Stenonius in 1654, whilst he visited that city and France for a short time to view the famous museum.

On his return to Leyden he took the degree of M.D. in 1657, publishing on the occasion a thesis on respiration. At this time he began to practise his invention of injecting the vesels with cereaceous matter, which seemed to keep them diffused when cold; a method from which anatomy has derived very important advantages. He applied very closely to dissection with Van Horne: and in the dissection of insects he was singularly dexterous by the aid of instruments of his own invention. The grand duke of Tuscany, who visited Holland in 1668, and who was introduced to Swammerdam by Thevenot, made him a liberal offer for his share of the collection, on condition of his removal to Florence; but he rejected the offer, on account of his abhorrence of the refinements of a court-life, and impatience of any control in his religion. Entomology was his favourite and principal pursuit; and in 1669 he published, in Dutch, "A General History of Insects," Utrecht, 4to.; afterwards reprinted, and translated into French and Latin, the latter with splendid figures. In 1672 he published, as a medical anatomist, a work entitled "Miraculum Naturae, seu Uteri Muscles Fabr. Systema in J. V. Horne Prodrom. Illustratum," Leid. 4to., many times reprinted. By intense application he became hypochondriac, and wholly unfit for society. In this state he was so impressed by the reverses of Antoinette Bourignon, as to be plunged into the depth of melancholy, and to be induced to abandon all his scientific pursuits. At her desire he presented to the world, in 1675, his last publication, which was an account, in Dutch, of the insect called Ephemera. He followed this fanciful female to her retreat in Holstein; and on his return to Amsterdam, his constitution was worn out by his mortifications, and he died in 1680. In the capacity of the paroxysms that seized him not long before his death, he burned all his remaining papers; but in a state of indigence he had disposed of the greater part to Thevenot for a trifling sum. On the lapse of about a half a century, these came into the possession of Boerhaave, who caused them to be published in Dutch and Latin by Gauibus, under the title of "Biblia Natura, sive Historia Insectorum in certa clausis redacta," &c. &c.: a vol., large folio, 1737, with plates; translated also into German, English, and French. The history of bees in this work is highly esteemed, as peculiarly valuable. Life by Boerhaave. Haller.

SWAMP, in Agriculture. See BOG and SWAMPT Land.

SWAMP-ORE, or indurated Bog-Iron-Ore, in Mineralogy, is ore of iron which occurs in swamps or moraines; it is a variety of bog-iron-ore, partially indurated by drying. The colour is a dark yellowish-brown, or grey; it appears coarsely, and contains cavities, but is sometimes compact. The fracture is earthy; the darker varieties have a small degree of lustre, but it is more common dull: it is very soft and friable. The specific gravity is 2.944.

This, with the other varieties of bog-ore, are sometimes used as ores of iron; but the phosphoric acid contained in them injures the tenacity of the iron; they are therefore generally melted with ores which yield the most duculites, to improve the quality. The phosphoric acid in bog-ore is probably derived from the animal matter in swamps.

The formation of bog-ore and its varieties takes place, according to Werner, in the following manner: "The water which flows into marshy places is impregnated with vegetable acid, formed from decaying vegetables, which enables it to dissolve the iron in the rocks over which it flows, or over which it stands. This water, having reached the lower parts of the country, becomes stagnant, and by degrees evaporates; the dissolved iron being accumulated in the additions of silt, becomes detached and forms the plates which are at first yellowish, earthy, and of little consistence; this is called morasche-ore; but as the ore becomes harder, the colour changes to brown; thus swamp-ore is formed. When the swamp is completely dried up, this ore becomes much harder, and at length passes into meadow-ore. Morasche-ore occurs in which all the different degrees of induration may be observed." Jameison's Mineralogy, 2d edit. vol. ii.

SWAMPY BAY, in Geography, a bay on the coast of North Carolina. N. lat. 35° 42'. W. long. 76° 7'.

SWAMPY LAKE, in Agriculture, such as is of a boggy marshy nature. Under this title are sometimes included, according to Mr. Marshall, "inland swamps, wet meadows and flat pufhure lands," which lie at the way of floods; yet are liable to be chilled by surface waters, and poached in, in wet seasons; by reason of the natural water-courses below them being "a state of neglect; or for the want of artificial courses being opened, to relieve them from surface waters, as they collect. And he adds, that lands of this description are now more particularly seen, in forests or other unappropriated and unregularized areas of lands that has taken place, they are less conspicuous. It is evident, that all lands of the swampy kind, whatever their situation may be, must require to be first drained before any other improvement can be effected. When this has been well accomplished by proper feeding and managing, they may, in most instances, be brought into a good state of sand, which is in general the best application of them, as they are seldom fit for the purposes of tillage. See Boa Draining of Land, and Spring-Draining.

In the appendix to the account of Elkington's mode of draining land, I have fully considered all the several different methods of improving these forts of ground may be seen, after they have been drained, laid down, and the various objects and intentions of them well pointed out and explained.

Lands of this nature are not unprofitably raised from a very trifling, or scarcely any value at all, to a very considerable one, simply by planting them with withy for the use of basket-makers and others. There are different sorts cultivated in this intention on such lands, as the red and
the yellow kinds for basket and sieve-makers, and the brown for being made into hurdles. The former are cut over frequently, mostly annually; but the latter only once in about five years.

In these cafes, the ground may be trenched up into beds about six feet in breadth, in the autumnal season, allowing two feet or more between each bed; then in the early spring they may be planted with the forts of withy which are most wanted for the above purposes, in three or four rows, at about a foot from plant to plant, or more, according to the wants.

The hurdles are very useful for hurdlng off tursips, natural and artificial grafts, and various other crops, which are to be fed by sheep or other sorts of stock.

SWAMRY, in Geography, a town of Hindoostan, in Mylore; 16 miles N.N.E. of Chitteldoog.

SWAMSCOT, the Indian name for Exeter, called the Great River, by way of distinction from another much lfs, also denominated Exeter river, an American river that rises in Cheever, in New Hampshire, and after running through Sandown, Poplin, and Brentwood, and a considerable part of Exeter, affording many good mill-fasts, precipitates itself over a fall 20 or 30 rods in length, and meets the tide from Piscataqua harbour in the centre of the township of Exeter. The smaller river rises in Brentwood, and joins the great river about one-third of a mile above Exeter. Here it affords plenty of alewives, and some oysters.

SWAN, in Abyronomy. See Cygnus.

Swan, Cygnus, in Ornithology, a species of the anas or duck kind, in the Linnean system, of which there are two varieties, the wild and tame swan. See Duck.

The wild swan, or anas oralus of Linneaus, called also elia and hooper, is less than the tame sort; the lower part of the bill is black; the base of it, and the space between that and the eyes, is covered with a naked yellow skin; the eye-lids are bare and yellow; the whole plumage in old birds is of a pure white; the down is very soft and thick, and the legs black.

The cry of this bird is very loud, whence its name hooper.

The wild swan frequents our coasts in hard winters in large flocks; but Mr. Pennant apprehends that it does not breed in Great Britain. Swans come in October in great numbers to Lingey, one of the Western isles, and continue there till March, when they retire more northward to breed. At Mainland, one of the Orkneys, swans are the countryman's almanac; as on their quitting the island, they presage good weather, and on their arrival, they announce bad.

See Cygnus under Duck.

The same swan, or anas cygnus manuactus of Linneaus, is the largest of the British birds. It is distinguished externally from the wild swan, first, by its size, being much larger; secondly, by the bill, which is red, and the tip and sides black, and the skin between the eyes and bill is of the same colour. Over the base of the upper mandible projects a black callous knob; the whole plumage in old birds is white; in young, ash-coloured till the second year; the legs dusky, and in some varieties red. The swan lays seven or eight eggs, and is nearly two months in hatching. It feeds on water-plants, insects, and shell-fish. No bird perhaps makes so elegant a figure out of the water, or has the command of such beautiful attitudes in that element, as the swan; thus described by Milton, Paradise Lost, book vii.

The swan with arched neck
Between her white wings mantling, proudly rows
Her face with easy grace.
SWAN-SHELL. See CIGNE.
SWAN’S-Egg Pear-tree, in Gardening, that fort of this
tree, which produces this fine eating pear. See PEAR-
Tree, and PYRAMID MAZE.
SWAN ISLAND, in Geography, an island of the United
States, in the district of Maine, and county of Hancock,
about seven miles long, situated on the Kennebec river,
which it divides into two navigable canals; 3 miles from
the shores of Merry-meeting bay. It contains 51 inhabi-
tants.

SWAN LAKE, a lake of Canada; 171 miles N.W. of
Quebec. N. lat. 49° 34'. W. long. 73° 15'.

SWAN POINT, a cape of the coast of Maryland, in the
Chesapeake. N. lat. 38° 11'. W. long. 76° 22'.

SWAN RIVER, a river of America, which runs into the
Mississippi, N. lat. 4° 34'. W. long. 93° 15'.

SWAN TRAIL, a town of America, in the district of
Maine, and county of Hancock; containing 251 inhabi-
tants.

SWANAGE BAY, a bay of the English Channel,
on the coast of Dorsetshire, S. of Studland bay.

SWANEVELT, or SWANEFELD, HERMAN, in Biogra-
phy, was born at Woerden in 1620, and, as it is said, was a dis-
ciple of Gerard Douw, whose style, however, he did not long follow; but as his disposition inclined him to landscape he traveled there in 1640, had the good fortune to become acquainted with the prince of landscape painters,
Claude de Lorraine; the beauty of whose excellent works
had long been his great object of emulation and delight. As
the pupil of that great artist, he became acquainted with his
principles of composition and colour; and having a fincer
attachment to his art, he studied with incessant care, devot-
ing whatever time he could to the contemplation of the
effects of nature among the interesting scenery which sur-
rounds the capital of Italy. So much did he incline him-
self among her antiquities, her ruins, and variety of mountain,
wood, and water, that he acquired the surname of the
Hermit; but his meditations were not destitute of himself
alone. The fruit of these combined studies was a high
rank among the professors of the branch of art he had
chosen; and though the scenery he adopted is less grand
and extensive than that of Claude, and his colouring less
beautiful and chaste, yet there is enough of talent to afford
great pleasure; and his figures are defined and executed
more correctly than those of his master.

He was among the few artists who receive the due meed
of praise and profit during their lives; his works were
eagerly coveted, and he received very high prices for them.
Since his time, a greater honour has been rendered to many,
at the expense of amateurs and connoisseurs, who have not
unfrequently purchased as the works of Claude de Lorraine,
pictures which were completed on the easel of Swanvelt.

Swanevelt was not only an agreeable and excellent painter,
but he also handled the etching-needle and the graver with
great taste and skill; and has left us many plates of land-
scapes and animals, which rival the best with considerable
effect.

SWANG, in Agriculture, a grassy or other piece of
meadow, lying low, or in a bottom covered, or liable to
be covered, with water.

SWANIMOTE, or SWAINMOTTE, a court touching
matters of the forest, kept, by the charter of the forest,
thrice in every year, before the verderers, as judges.
This court is as incident to a forest, as a court of pie-
poudre to a fair.
Its jurisdiction is to inquire into the oppressions and
grievances committed by the officers of the forest, and to
receive and try pretentions certified from the court of
attachments against offences in vert and venison.

SWANLINEBAR, in Geography, a fair-town of the
county of Cavan, Ireland, much referred to in the summer,
on account of its medicinal sulphureous springs. It is
situated in the midst of the mountains in the N.W. of the
county, and is 13 miles N. by W. from Killefadra, and
74 N.W. from Dublin.

SWANNO, the east head-water of French Broad
river, in Tennessee.—Also, the name of a settlement within
about 60 miles of the Cherokee nation.

SWANSBOROUGH, the chief town of Onslow county
and Wilmington district of North Carolina.

SWANSEA, or SWANSEY, a sea-port and market-town of
considerable importance, in the hundred of the same name,
Gloucseshire, South Wales; is situated 45 miles W. from
Cardiff, and 205 miles W. from London. The Welsh
name of this place, Abertawe, is derived from its situa-
tion on a point of land near the junction of the river Tawe
with the sea. The etymology of its English appellation is
said to be eald-ascertained: it is supposed that it was originally
written Swinelea, or Swanley, as intimated by Camden,
from the porpoises which abound in the Britifl Channel.
The town lies on the western side of the Tawe, which is
here navigable for ships of large burden; and has extensive
canals, with every facility for loading and unloading the cargoes.
It extends in length about a mile and a half; the greatest width does not exceed half a mile.
The streets are numerous, and contain some well-built	house, occupied by opulent individuals, among whom are
many professional men of eminence, merchants, and substan-
tial tradesmen. In the return to parliament in the year
1811, Swansea (including the hamlet of St. Thomas) was
certified to contain 1702 houses, and 8195 inhabitants.
The population in the summer season, from the great influx
of strangers who resort hither for the purpose of sea-bathing,
must, however, be much more considerable. This circum-
stance has occasioned the erection of a great number of
lodging-houses, in general very handsomely, and many of them
adapted for the reception of families of the first distinc-
tion. The principal manufactories at Swansea are the potteries,
for which there are two establishments on a large scale.
Large quantities of the ware are annually shipped for the
English markets. A soap manufactury has been recently
established by the river-side, which promises to reward the
speculation of the proprietors. The commerce of Swansea
is very considerable; the numerous population of the town
itself, with the important addition of the persons employed
in the collieries, iron and copper works, and other manu-
facturing establishments in the vicinity, cause a large demand
for manufactured shop-goods and articles of consumption,
which are imported from Bristol and other English towns,
while the mineral treasures supplied by the hills in the in-
terior, create an export trade of great extent. The chief
article furnished for exportation is coal, particularly of
those kinds called stone-coal and culm, brought down by
the canal which conveys them to the river-side. Some idea may be formed of the shipping-trade of Swansea,
and of its rapid increase of late years, by the following
comparative statement, taken from the custom-
house books. The number of vessels entered out in

<table>
<thead>
<tr>
<th>Year</th>
<th>Vessels</th>
<th>Tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1768</td>
<td>694</td>
<td>30,631</td>
</tr>
<tr>
<td>1790</td>
<td>1697</td>
<td>74,026</td>
</tr>
<tr>
<td>1800</td>
<td>2590</td>
<td>154,264</td>
</tr>
<tr>
<td>1810</td>
<td>2747</td>
<td>171,072</td>
</tr>
</tbody>
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The corporation have been laudably exerting themselves...
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many years in improving the harbour. In 1791, an act was obtained for raising the necessary funds, and great sums have been expended in clearing and deepening the bed of the river, and removing some obstructions at its entrance from the sea. Two large and handsome piers have also been run out, one from the eastern, the other from the western side, to confine the channel, and afford shelter for large ships, which might be loaded here without proceeding to the quays. But the intent not having been fully answered, a short crofs pier was formed in 1814, to supply the deficit.

Swansea is divided into three parts; the town, the facing, and the parish, each of which has its own officers for parochial and local purposes. The town is corporate, and shares the privilege of Cardiff, as a contributory borough, in the return of a member to parliament. The corporation consists of a portreeve, twelve aldermen, two common attorneys or chamberlains, a recorder or town-clerk, and two serjeants at mace. By its charter it is empowered to hold two weekly markets, on Wednesdays and Saturdays. The former is little more than nominal; but the latter is one of the best attended of any in the principality. Here are four annual fairs. The Michaelmas quarter-days for the county are held here; as are also the courts-leet and courts-baron of the duke of Beaufort for the lordship of Gower. The town-hall is a spacious modern edifice, built on a part of the castle inclosure in the centre of the town. A commodious theatre has been lately erected by Toutine shares of 10l. each, the survivor of the holders to become the sole proprietor. Some public rooms have been since built on a similar plan. A free school was endowed, in 1684, by Dr. Hugh Gore, then bishop of Waterford; and many low-chapels have been recently established for the education of the poor. The whole of Swansea is comprised in one parish, the church of which, a modern structure, consists of three aisles, separated by two rows of pillars, with a large square tower. The old church fell down in 1753; some fragments of the walls still remain. Near the upper end of the town is a small church, called St. John’s; but the parish to which it belongs is a mile distant. Here are also several places of worship, for various denominations of dissenters. The Presbyterian meeting is one of the oldest in South Wales. On an elevated spot in the middle of the town, are the remains of the castle; the principal portion which remains entire, is a lofty-circular tower, on the eastern side of which is a large part of the original building, surmounted by a parapet. According to Caradoc of Llancarvan, this castle was built, in 1099, by Henry Beaumont, earl of Warwick, to secure his new conquest of the district of Gower, (in which district Swansea is situated.) After the subjugation of Gower, Henry Beaumont brought over a colony of English settlers from Somersetshire, to whom he gave a large portion of the lands. Their descendants yet remain here, separated by their manners and language from the native population, with whom they scarcely ever intermarry. Swansea castle is the property of the duke of Beaufort, who holds the lordship of Gower. The ancient mansion of the lords of Gower stood near the castle, but was taken down about thirty years ago, and a street formed on its site. Swansea was the birthplace of the celebrated Richard Nafi, master of the ceremonies at Bath. He was born in October 1673, and died in February 1761. The poet Gower, contemporary with Chaucer, is considered by the Welsh antiquaries as a native of Swansea.

About five miles from Swansea is Oystermouth castle, a bold and majestic ruin; the grand gateway and some other parts of the building are in good preservation. This edifice is supposed to have been another of the earl of Warwick’s fortresses, as are also Penmarth castle and Penrice castle, of which some remains are at a short distance from Oystermouth.

On Cefn Bryn, a mountain which rises to the northward of Penrice, is an immense cromlech, called Arthur’s stone, noticed by Llwyd in his communications to Gibbon’s edition of Camden’s Britannia. The supporting stones are in number, and about four feet high; and the covering stone is supposed to weigh about twenty tons.

Stoutcastle, at the foot of this mountain, is the elegant seat of John Lucas, esq., who has displayed great taste in the disposition of his pleasure-grounds and gardens. In the latter he has excavated a cave of prodigious depth, calculated to be sufficiently capacious to contain two thousand men.

At Llangennith, in this vicinity, was once a priory, founded by Roger, earl of Warwick in the reign of Stephen. Henry VI. granted it to All Souls’ college, Oxford, in 1441.—Beauties of England and Wales, vol. xviii. South Wales, by the Rev. T. Rees, F.S.A.

Swansher, a town of America, in Bristol county, Massachusetts, incorporated in 1667, and containing 1839 inhabitants; 51 miles S. of Boston.

Swanshal, a town of Sweden, in Weft Gothland; 25 miles W.S.W. of Linkoping.

Swanton, a post-town of America, in Franklin county, and state of Vermont, on the E. bank of Lake Champlain, and S. side of Michicou river, which is navigable for the largest boats seven miles to the falls in this town. The town contains 1679 inhabitants.

Swantown, a small town of the state of Maryland, in Kent county; 3 miles E.E. of Georgetown.

Swanzey, a township in Cheshire county, New Hampshire, adjoining Chetserfield on the E., 97 miles W. of Portsmouth; incorporated in 1753, and containing 1400 inhabitants.

Swape, in Rural Economy, a provincial term signifying a long pole, turning upon a fulcrum, for raising water out of a shallow well, for churning with, or other similar purposes.

Sward, or Sward Land, in Agriculture, the green or gravel surface of the ground. In order to have a fine sward, much attention is necessary to feeding down the grass, as well as keeping it free from all sorts of rubbish of the weed kind. See Laying down to Grass, and Grass-Land.

It is that sort of land which is in the state of grass, or which has a sward upon it.

Sward-Cutter, an implement invented by Mr. Sandlands, and described in the sixth volume of the Bath Papers, for the purpose originally of preparing old grass-land for the plough, by cutting it across the ridges, in the beginning of or during winter, when the land is soft, in order to answer all the intentions propounded by Mr. Tull with the four-coultur plough, for bringing grass-land that has been long refitted into tility. This the sward-cutter has been found to do, the inventor says, much more effectually and expeditiously; as Mr. Tull’s plough, with four coulters, cuts the sward in the same direction with the plough, and is liable from every stone, or other obstruction any of the coulters may meet with, to be thrown out of its work altogether, or the instrument be broken, to which the sward-cutter, consisting of four, six, or more cutting-wheels, is never liable, from their being entirely independent of one another, cutting the ground across the ridges before ploughing, and rendering that operation easier to two horses than it would
be to three, without its being cut. The furrow, being cut acros, falls finely from the plough in squares of any faze required, not under six inches, in place of long slips of tough sward, felldom and imperfectly broken by the four-coulted plough. It is suppos'd, that any person who sees Mr. Tull's description of his four-coulted plough, and what he propos'd by it, will soon see the great advantage the fward-cutter has over it, in producing the desired effect of bringing old reed gras-ground into tilth; an object universally allowed to be of no small importance to agriculture.

Besides, it is an implement which is suppos'd very fit for preparing ground for burnishing, as it will save much hand-labour. It may also be properly used in croft-cutting clover, of one or two years' standing, to prepare the ground for wheat, if the land be stiff and moist enough. It may also be applied to cutting and croft-cutting pasture-ground, intended to have manure of any kind put upon it to meliorate the soil. In that, it will far exceed the scythe-cutter, as that instrument is liable, as well as the four-coulted plough, to be thrown out of its work when meeting with a stone or other interruption. This the fward-cutter is proof against; which is looked on as its greatest excellence. And in preparing for barley, the fward-cutter, it is said, excels a roller of any kind, in reducing the large hard clods in clay-land, occasioned by a sudden drought, after its being ploughed too wet; and it is likewise very proper for reducing such clay-land, when under a summer fallow. In this operation the fward-cutter is greatly to be preferred to the cutting-roller, both from its wheels being all dependent on one another, so that when one is thrown out by a stone, three or four more share the same fate: besides, the cutting-roller has but seven wheels in six feet, and the fward-cutter has fix in four feet three inches, at nine inches distant; and, if necessary, may have them so near as six inches. It is added, that after old gras-ground is cut acros with the fward-cutter, and ploughed, it has a very uncommon and work-like appearance, from each square turned over by the plough being raised up an inch or two at the side last moved by the fward-cutter, so that the ground, when plough'd, is all prettily waved, and resembles a piece of water when blown on by a gentle breeze. By this means, a very great deal of the land's surface is exposed to the frost, and other influences of the air, which cannot fail to have a good effect on it. And it is found that two horse are sufficient for the draught of a double-horfe fward-cutter, and one horse for a single-horfe one: one man manages the machine, and drives the horfes. The workman begins his operation by first measuring off twenty or thirty paces from the machine, fels or more, as he inclines, and thence fixes a pole. He then cuts the field acros, as near at right angles with the ridges as he can. When the cutting-wheels are past the last furrow about a yard, and the machine is upon the outmost ridge of the field on which it must turn, he must ftop the horfes, then take hold of the levers, and by pulling it to him, raise the cutting-wheels out of the ground, which are kept fo, by the loop of the rope being put over a pin for the purpose, in the lever, till the machine is turned and brought to its proper place, which is done by measuring off the same distance formerly done on the opposite side of the field. When the cutting-wheels are exactly over the outmost furrow, then, on the horfes being ftopped, fip off the pin, and the lever returns to its former place, which allows the weights to force the cutting-wheels into the ground again. He then goes on till the interval betwixt the first and second froke of the machine is all cut. In this manner the field is to be finished, after which you may begin to plough when you please. It is remark'd, that there must be a pole at each side of the field. But it is of no confequence whether the land to be fward-cut is in crooked ridges, or at right; in flat ridges, or in very high-raised ridges, such as are frequently met with in Scotland. Be the surface ever so uneven, it does not signify, as the cutting-wheels, being all independent of one another, are forced by their weights into the furrows cut by the machine.

Farther, one fward-cutter, it is said, will cut as much as one day on six ploughs will plough. It is added, that the land may lie several months in winter after being fward-cut, when there is no vegetation to make the cuts grow together again before it is plough'd; but the sooner it is plough'd after cutting, the better, that it may have the benefit of all the winter's frost, which makes it harrow better and easier at feed-time. When the ground is harrowed, the harrows ought to go with the waves that appear after ploughing, not against them, as by that means they are apt to tear up the furrows. The cut into squares. This not only be allowed to respecting the first two times or three, as they are called, or the harrowing. And it is observed, that any common wright and smith may make the implement. It is very strong, very simple, and easily managed, and moved from place to place; and if put under corn, will last many years. A representation of it may be seen in the work noticed above. Other implements of this kind have been invented, and recommended by different other persons; and one is said to have been lately invented and confuted in Lancashire, which has no tooth tappet.

**Sward-Dresser**, the name of an implement contrived for the purpose of drefling and improving the sward of land in the state of graces. An useful tool of this fort has been described by Mr. Amos, in his Minutes on Agriculture and Planting, where he has advised the use of it for levelling and drefling graces-land, whether it is to be mown or depurated with animals; and that the best time of performing the operation with it, is from the middle of February to the middle of April. And that, in general, drefling the land in this way may be sufficient; but if the sward be very mossy or weedy, the field is first mown with a mow and cross, then drefled with a large cross-cutter, cleaned and rolled; the implement being occasionally cleared from rubbish.

And it is suggested, that if the sward be thin, it may be thickened very much, by laying eight or ten tons of rota dung on, and fowing seven pounds of white clover, four pounds of wild or cow-clover, four pounds of trefoil, four pounds of rib-graces, and one peck of the best ye-graces feeds, per acre, previously to its being drefled in this way; bultharrowed, cleaned, and rolled. He thinks, that by drefling land in this way by this tool, moss is torn up, set and mole-hills levelled and destroyed, the roots of the grass cut, and horfe-hoed, which causes them to throw out fresh lateral shoots or flemes, the sward thickened, and the grass made so clean as to put on the finest appearance, when kept clofe fed down. And that by such management, and grazing as much fcock as will keep the graces in a young proficient state, and hobbing or mowing all the tufts and weeds three times in the course of the summer, the grazier will be enabled to receive every benefit from his land, and likewise prevent the flemes of several graces from running to foal, and being thereby injured, as well as the land.

**This fort of tool is contrived in somewhat the same manner as other implements of the same nature, having two strong pieces of wood which form the outer side-frames, 12 feet long, and twelve by three inches square, shaped as in the ordinary tools of this fort: there is a coultter-bar, 6 feet 8 inches long, and four by three and a half inches square, and...**
The people who manage bees, are informed of the time when they are going to send out new swarms by several signs. One is, when the hive is so peopled, that many of the bees cannot find room within; but stand in clusters on the outside of the hive; another is the appearance of a large number of drones, or male bees, especially if the weather be clear, calm, and warm; for in a cloudy, wet, and floridly seafon, the first swarms seldom or never rise, though the cathers, or second swarms, often rise in indifferent weather: these, however, are not certain signs, nor do they point out the very day of the swarming; but there is one which declares it very punctually, which is the obseving, that though the hive be very full, and the day very fine, yet very few bees go out in search of honey; in this case it is a certainty that they are assembling themselves in the hive, and preparing to be gone in a very little time. If a person go near the hives, that are ready to send out swarms, in the evening, or even in the night, he will hear a fort of humming noise in them, which is not to be heard at inch times on any other occasion: in short, the whole is in agitation on the occasion, and the tumult never ceases till the new colony goes out.

The signal of the going out of a swarm from a hive is sometimes only a humming noise made by one single bee, but that a very particularly acute and clear sound: this seems to be the voice of the new queen, or female bee, calling together the swarm that is to follow her out, and animating them with a fort of martial music for the great adventure they are going to engage in.

It is rare to hear these previous notices given for a first swarm; but the time of second swarms may generally be fixed within a day or two; by means of these distinct and musical notes, which are always heard two or three days before they rise. Eight or nine days after the first swarm is gone, one of the young princesses, addressing herself to the queen-mother, petitioning for leave to withdraw and erect a new empire, with a select body of the populace. For a day or night the regent gives no answer, but the young princess perfils in her suit, and at last succumbs. The second night the queen, with a very suldible voice, issues her royal grant, and proclames it through the whole kingdom; and the following day, the weather being tolerable, you may expect the swarm. When it is ready to come forth, the notes are louder, quicker, and more constant; when the greater part of the swarm is out, the music is then at an end.

All the different modulations of sounds made by the bees, are the effect of the different vibrations of their wings in the air. It has been supposed by Swammerdam, that the air issuing from the stigma of the body was very instrumetal to the making of this sound; but this is proved to be an erroneous conjecture, by the easy experiment of cutting off a bee's wings, which always renders the creature perfectly mute, though this could not be the case, if the voice proceeded from other parts. It is evident, therefore, that all the sounds of the bee are made by the stiking of its wings against the air; and it seems very easy to imagine, that when the motion of wings can make a sound, the more quick or slow motion of them can modulate it in a different manner, and the moving them in several different directions may add greatly to the variety.

The hours of going out of swarms are generally between eleven in the morning and one or two in the afternoon; the air is at this time very hot, and the sun often shines brightly on the surface of the hive: the effect of this, in causing them to go out, is easily conceived. The few who are nearest the mouth of the hive, and are ready to follow their queen, soon find that this is a pleasant season for their expedition, and the numbers of others, which remained irreligion the inner...
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parts of the hive, now find the natural heat of the place increased to a great degree by the action of the external warmth, that it is very natural for them to resolve at once to depart with those which are going off, in order to find a place where they may be more at ease, or less crowded and heated in their habitation. People who have the care of bees should attend to their swarming, or going out on these occasions; and if they are not at leisure to watch them in the hours before mentioned, should defend the hives, during that part of the day, from the heat of the sun, that they may not go off and be lost.

Immediately before the going out of a swarm, there is heard a peculiar humming in the hive, much greater than what is heard at any other time, and immediately after this, the openings of the hive are crowded with bees, in a violent hurry to get out; those which first come out immediately take flight, and if the female, or queen, be among these, vast numbers immediately follow, and the air is seen as full of them as it is of flakes of snow in a winter storm; and, in fine, it is not a minute before all the bees that are to make the new swarm, are out of the hive: when the body is thus joined, they rise and fall in the air, and seem very curious in circling the hives of bees, and there to fix themselves. It does not appear that the female bee chooses the place for them, but they all seem to be affiant in it; and as soon as they have fixed upon a proper branch of a tree, or the like, they all fly towards it, and begin to form a cluster in one part of it. The female does not place herself at the head of this cluster, but sits on the branch near it, to see how it approves the management: as soon as the cluster is of a proper size she adds herself to it, and from that instant it thickens in a surprizing manner, all trying first to fix themselves to the leaf, so that in a quarter of an hour they are all collected together in a vast mass, hanging to one another by the legs. In this condition they remain absolutely quiet, though exposed to the open air, and there are no more of them seen flying loose about, than there are about the hives in a summer's day.

When the time of a swarm's going out of the hive is expected, the people who have the care of them, should always be prepared with a hive to receive them; and when the swarm settles upon some branch of a bush, or low tree, the hiving of them is an easier matter than could be imagined. See Hiving.

Bees are commonly placed in gardens, that the bees may have some flowers at least in their own neighbourhood, and not be compelled to go far in search of food; and the swarms from these hives always succeed best, when there are some bushes, as of filders, barberries, or the like, in the garden, as well as high trees; for when the bees take a high flight, they often take a very long one before they settle, and sometimes go so far, that the eye cannot trace them to the place of their settling; in which case, all attempts to search for them are uselessly vain, and they are lost entirely. The low bushes in view usually determine them to low flights, and if they are seen to be ascending too high, the culom is to throw handfuls of dust and sand upon them; this usually brings them down, as they probably mistake the particles for drops of rain.

When the weather, for some days after swarming, is unpropitious for the bees going out, they should be fed with care until it gets fine, otherwise there will be great risk of the young swarm dying, or being destroyed.

Another very ancient custom, and which is continued to this day, is the placing upon instruments of brass, and the like, to make a great noise while they are gathered in the air: it is pretended, that this compels to fix themselves the sooner. The origin of this custom has been an observation, that thunder always sends those bees which are abroad, from the flowers back to the hive, and it is supposed that this artificial noise may have the same effect; but, in all probability, the bees are better acquainted with thunder than to be thus deceived: there is indeed much more probability of their mistaking the particles of dust falling upon their backs for drops of rain, than taking to unlike a sound for thunder; for it is found by experience, that the making all the noise that can be conceived this way, never was able to drive one bee from a flower where it was busy, or to lead one to a fraggler home. Reaumur Hist. Inf. vol. x. p. 390. Tho- ley's Enquiry, &c. c. 6.

SWARM. After See AFTER-SWARM.

SWAROCHESHA, in Hindu Fabulous History, is name of one of the holy men named Menus. (See Maxe.)
The name of this person is seldom met with.

SWARTA, in Geography. See SCHWARTA.

SWARTA, a town of Sweden, in Sudermanland; 4 miles N.E. of Nykoping.

SWARTEBERG, a town of West Gothland; 16 miles N.W. of Uddevalla.

SWARTH, in Rural Economy. See SWATH.

SWARTH-HORN, in Geography, a mountain of Switzerland, in the country of the Cufions, being part of the Scaletta Alps, which communicate with the Julian Alps, the Satt, and the chain that separates the Valteline from Upper Engadina and Pregalia.

SWARTOW, a river of Holstein, which joins the Tawe; 3 miles N. of Lubeck.

SWARTSLUYS, a forter of Holland, in the department of Overyssel, situated on the river Vecht, in a marshy country, defended by five bastions; 28 miles W. of Corisandor.

SWARTZIA, in Botany, a name given by Schreber to the Tournata of Aublet, in honour of Olof Swartz, M.D., the present Berigian professor of botany at Stockholm, a faithful pupil of Linneus, and one of the best botanists of this or any age. His various Cryptographic works, to his credit than his West Indian flora, entitle this amiable and liberal writer to universal respect. Ritter of Schreber, let the article, proves the fame genus. Another Swartzia was indeed founded by Hedwig, in his Crypt. v. 2. 72; but this latter, a genus of Molluscs, is unquestionably not dihid on Thalamostomum, as was supposed, but in its proper place.—Schreb. Gen. 518. Wild. Sp. v. 2. 1219. Mart. Mill. Dict. v. 4. (Tournatae; Aubl. Gen. 594. Juss. 440. Lamarck Dict. v. 7. 716. Illutr. t. 46.) Ritter; Schreb. 564. Swartz Ind. Occ. 955. Pallas; Aubl. Guian. 934. Swartz Prod. 81. Juss. 557. Lamark Dict. v. 5. 576. Illutr. t. 461.—Cladis and arbors, Polyandra Mongomyn. Nat. Ord. Putamince, Linn. Coparides, Juss.

Gen. Ch. Cal. Perianth inferior, of one leaf, coriaceous, permanent, in four deep, ovate, rounded, concave, reflexed, nearly equal segments, coloured on their inside. Cor. Petal one, lateral, erect, roundish or oblong, fringed, with a short claw. Stam. Filaments numerous, longer than the corolla, inserted into the receptacle, awl-shaped, some of them, which are opposite to the petal, shorter and imperfect; others roundish, incumbent. Pili. German small, oblong, compressed, declivous, or incurved; style short; stigma oblique. Peric. Pod oblong, tumid, compressed, of one cell and two valves. Seeds few, oblong, tunicated.

Exf. Ch. Calyx in four deep segments. Petal foliaceous, lateral. Pod of one cell, with two valves, and a few tunicated seeds.

Obf. As the Swartzia and Ritter of Schreber are in-
satisfied by Vahl and Willdenow to be one and the same genus, we have endeavoured to make our description of the fruit answer to both, presuming there may be some inaccuracy in one or other of Aublet's descriptions, and not having more than the enlarging germs of Rittera only.

1. S. simplicifolia. Simple-leaved Swartzia. Willd. n. 1. (Rittera simplicifolia; Vahl Symb. n. 2. 60. Swartz Ind. Occ. 936.)—Leaves simple, elliptical, with a blunt point. Petal roundish, longer than the calyx. Stamens very numerous. —Native in thick woods; flowering in June. A shrub, ten feet high, with alternate, round, smooth, leafy branches, minutely dotted with whitish elevated points. Leaves flaked, alternate, somewhat coriaceous, broadly elliptical, about three inches long, or more, entire, with a short, blunt, rarely emarginate, point; bright-green and smooth on both sides, with one rib, and numerous, transverse, parallel, interbranching veins. Footstalks half an inch long, smooth, channelled, with two small, acute, deciduous, terminal teeth. Stipulas opposite, falcate, deciduous, Flower-stalks naked or terminal, racemose, shorter than the leaves, bearing from two to eight or ten large, yellow, fragrant flowers; whose upper stamens are thickest and longest, with oblong curved anthers; the lower, next to the petal, shorter and capillary, with ovate twin anthers. Seeds scarcely more than two, black, with a white scar, attached to the lower future of the pod; we nevertheless can hardly term it a legume.

2. S. grandiiflora. Large-flowered Swartzia. Willd. n. 2. (Rittera grandiiflora; Vahl Eclog. n. 2. 37. Plant. Amer. 90. t. 91.)—Leaves simple, oblong-ovate, pointed. Teeth of the footstalks oblongate. Stalks about three-flowered. Petal very large, kidney-shaped.—Native of the island of Trinidad. Very much like the last, but apparently different. The leaves are narrower, thinner, and more pointed. Teeth of the footstalks not deciduous. Petal larger. Better characters may hereafter be discovered by those who have an ambition of comparing good specimens of both plants. Vahl.

3. S. dendracandra. Dendracandrous Swartzia. Willd. n. 3. (Rittera dendracandra; Vahl Symb. n. 2. 60. t. 34.)—Leaves simple, ovate, nearly sessile. Petal oblong, about the length of the calyx. Stamens less than twenty. —Native of South America. Von Robr.—The branches are round; downy towards the extremity. Leaves alternate; on very short, minutely toothed, flanks, ovate, two or three inches long, membranaceous, very smooth, with a blunt emarginate point, one rib, and many transverse veins. Stipulas falcate, rather longer than the footstalks. Clusters axillary, shorter than the leaves, lax, slender, of four or five flowers, with a pair of falcate bracteas under each partial flake. Petal obvate-oblong, rather longer than the calyx, but shorter than the stamens, which are from fourteen to nineteen in number, yellow and thread-shaped. Vahl.

4. S. triphylla. Larger Three-leaved Swartzia. Willd. n. 4. (Polifra triphylla; Swartz Prod. 82. Ind. Occ. 937, note. P. arborescens; Aubl. Guian. 354. t. 355. Rittera; Schreb. Gen. 364.)—Leaves ternate, elliptic-oblong. Stamens about twenty-five, longer than the petal. —Found by Aublet, in the forests of Guiana, bearing flowers and fruit in May. The French call it Nota a flekis, or Arrow-wood, because the wood serves the natives to make points to their arrows, being very hard and close, of a yellow colour. The tree is of a middling size, with a trunk seven or eight feet high, and as many inches in diameter, crowned with spreading, round, smooth, wavy branches. Leaves ternate, dark-green, smooth and shining; paler beneath; the middle leaflet most elliptical, acute at each end, three or four inches in length; the lateral ones more ovate, and much smaller. Common footstalk flattened above as if winged; convex beneath; short in the part below the lateral leaflets, each portion tipped with a pair of very conspicuous, acute, deciduous teeth. Stipulae orbital-shaped, somewhat hairy. Clusters axillary, slender, of but few flowers, with pairs of falcate bracteas like the former. Petal round, emarginate, yellow, twice as long as the calyx. Stamens twenty-five or twenty-six (Aublet), fix or free of which, next the petal, are shorter and imperfect. Pod smooth, coriaceous, containing from one to four angular seeds, of an acrid and even caustic quality, all "attached by a fringed umbilical cord to a marginal receptacle." 

5. S. myrtifolia. Myrtle-leaved Swartzia. Leaves terminal or pinnate, lanceolate-oblong; with a bordered flake. Stamens very numerous, polyadaphous, as long as the calyx, scarcely so long as the petal. —Gathered in the Caraccas, by J. Mzrtor, M.D. who favoured us with a specimen on his return from that country in 1791. This resembles the last in general appearance, but the flowers, which are only one-third as large, and often pinnate of five or seven petals, as well as terminal, on the same branch. The footstalks are similarly toothed at the top of each joint; but the stipulas are mostly lanceolate, leafy, and considerably larger. Petal orbital, white or yellowish. Stamens extremely numerous, capillary, variously combined at the base, in which they accord with our seventh species.

6. S. pinnata. Pinnate Round-flaked Swartzia. Willd. n. 5. (Rittera pinnata; Vahl Eclog. n. 2. 38.)—Leaves pinnate, their common flake deciduous. —Native of the island of Trinidad. We know nothing of this species but from Willdenow, whose specific character is decisive.

7. S. alata. Pine Leaf-flaked Swartzia. Willd. n. 6. (Swartzia; Schreb. Gen. 518. Touantes guaniensis; Aubl. Guian. 550. t. 218.)—Leaves pinnate, elliptical; with a bordered flake. Stamens numerous, polyadaphous, much longer than the calyx.—Found by Aublet in the forests of Guiana, bearing flowers and fruit in November. —A tree, whose trunk attains the height of twenty-five feet, or more, and is above a foot in diameter. The bark is smooth, ash-coloured; the wood whitish, not very compact. The wide-spread branchlets are round, smooth and leafy. Leaves alternate, as large as those of our common Walnut, but firmer, of five leaflets, whose length is from three to eight inches; their upper side polished; under opaque, finely reticulated with veins. Each joint of the winged common flake is obliquely toothed at the summit. The flowers, of which we have seen no specimens, are described by Aublet as very small, growing many together in simple lateral clusters; about fix inches long, with a little scale, or bracteas at the base of each partial flake. Calyx in four deep acute segments, of a dirty white. Corolla none. Stamens very numerous, twice the length of the calyx. Capule ovate, yellow, of two concave valves, containing one vertical, oval, black seed, filling the cavity of the seed-coat, and enveloped at its base with a white, membranous, notched tunic. Such is Aublet's account, confirmed, in the main, by Schreber, who appears to have examined a dried specimen himself, and who found no petal, unless what he took for an occasional fifth segment of the calyx might be a bud. What has that appearance in Aublet's plate, is perhaps the genua. The fruit differs much, in shape at least, from the other species; but probably Vahl, who had more ample materials than have come in our way, has settled all these difficulties, and we have not his work at hand.

SWASH, Lower, Upper, Nine-feet, and Twelve-feet, in
Vol. XXXIV.
Both these Menus are said to have had ten sons by wives named Satarupa, who appears sometimes as the confessor of fakti both of Brahma and Siva; corresponding, in the case, with Saraswati and Parvati. See SAKTI.

The following extract from Wilford's learned Essay on the Chronology of the Hindous (Afas. Ref. vol. v.), will introduce us more particularly to the subject of this stick, and to some other important personages mentioned herein. "Swayambhava, or the form of the self-existing, was the first Menu, and the father of mankind; his confessor was Satarupa. In the second Veda, the Supreme Being is introduced thus speaking: 'From me Brahma was born; he is above all; he is Pitama, or the father of all men; he is Aja, and Swayambhava, or self-existing.' From him proceeded Swayambhava, who is the first Menu: they call his Adima (or the first, or Progenitous): he is the first of men; and Parama-Parutha, or the first male. His brother, Parakrta, is called also Satarupa: the is Adima, or the first; she is Visva-jenni, or mother of the world; she is Iva, or like I, the female form of nature; or if she is form of, or descended from I; she is Parva: both are like Mahadeva and his fakti, (the female energy of nature,) whose names are also Iva and Iva."

Another legend from the sacred books of the Hindous, explaining, after their manner, the origin of Satarupa, and of Brahma's four faces or heads, may be here introduced. "According to the Matiya Purana (see Purana) Brahma, in the north-west part of India, about the Assam, assumed a mortal shape; and one half of his body sprang out of it without his suffering any diminution whatever: he framed out of it Satarupa. She was so beautiful that he fell in love with her; but having sprung from his body, he considered her as his daughter, and was ashamed. During this conflict between shame and love, he remained motionless with his eyes fixed upon her. Satarupa perceiving his emotion, and to avoid his looks, stepped aside. Brahma was able to move, but still desirous to see her, caused a fire to spring up in the direction to which the moved. She filled her place four times, and as many faces, corresponding with the four quarters of the world, grew out of it. Having recovered his heart, he despatched his body to sprang from him, and became Swayambhavata."

(Willard, in Afas. Ref. vol. vi.) A legend, something similar, of Brahma's producing and falling in love with his own work, is given in the article MUNI. In these several allegories, to which the Hindous, common with the poetical chroniclers of Egypt and Greece, were so prone; and in which, if taken literally, we see little more than absurdity and incoherence.--In many of these allegories are doubtless buried historical and physical facts. We shall not endeavour to develop whatever may be hinted in the tales above quoted. We may, however, just hint, that in the consideration of Brahma being a perfonament of matter, or the earth, a clue may be found to some of the fables relating to his offspring, emanations, absorptions, &c., &c. See SARASWATI.

SWAYING, in Sea Language. See JERKS.

SWAYING of the Back, among horses and other animals, is a kind of lumbago, known by a pain and weakness in the loins. It may be caused by a fall, the carrying of a heavy burden, or some other violent accident; or a relaxation of the muscles of the back. Bleeding, blistering, and sweating, are useful in these cases, for the moat part; and the diet must be opening, and all imaginable care taken to keep down a fever. If a horse, he ought to be girt pretty firm over the loins, but not so as to hinder the motions of his flanks. SWEAING.
SWEALING. See Swallowing.

SWEARING. Porrane. See Porpaness.

SWEARING the Peace. See Peace.

SWEAT, a saline moisture issuing out of the pores of the skin of animals, through too much heat, exercise, or weakness; or through the action of certain medicines, called sudorifics. See Inrumentum and Perspiration.

SWEATH. See Swath.

SWEATHY. See Sweaty.

SWEAT, a disease of the natives of North America, when first settled among them, had a great many houses to sweat in, being their general remedy for diseases of whatever kind; but at present they are little used among them.

The cave, or sweating-house, was usually eight feet in diameter, and four feet high, the roof being supported by sticks, or boards. They usually dug these caves in the side of a hill, and near as could be to some river, or pond. The entrance into the cave was small, and when any person was sweating in it, the door was covered with a blanket or skin. Near the cave they used to make a large fire, and but in this a quantity of stones, perhaps five hundred weight: these they rolled into the cave, and piled up in a heap in the middle. When this is done, the Indians go in naked, as many as please, and sit around the heap of stones; and as soon as they begin to grow faint, which is usually in a quarter of an hour, they come out, and plunge themselves all over in the water, remaining in it a minute or two; and repeating this a second time, they dry themselves, and go about their business.

This has been for many ages used among them with success, in cases of colds, fevers, scalds, and pains fixed in their limbs; and the English have often used the same means, and found relief by it. It is practised equally at all times of the year, and the Indians do it not only in sickness, but by way of refreshment after long journeys, and other fatigues, and to strengthen themselves for any expeditions. Philos. Trans. 1384. p. 151. See Bath and Sudatorium.

SWEATING-Turf. See Turf-Sweating.

SWEATING-Iron, in the Mancro, is a piece of a fishy bone of about a foot long, and of the breadth of about three or four fingers wide, and is used only as cut up with one side. When a horse is very hot, and the grooms have a mind to leffen the sweat, or make it glide off, they take this knife or iron in their two hands, and gently run the cutting edge along the horse's skin, commonly with the grain, or as the hair lies, and but seldom against it; with intent to scrape off the sweat, and dry the horse.

SWEATING-ROom. See an account of the remains of a Roman sweating-room in the Philosophical Transactions, 1384. See Hypocaustum.

SWEATING-ROom for Chetfes, in Rural Economy, that fort of room or place which is appropriated to or for the purpose of sweating them in. It should be constructed, as to be readily capable of being kept up to the most suitable temperature for this use; and be conveniently situated for the chef's-room, and other places destined for carrying on the practice of cheese-making. It has been well observed by the writer of the Corrected Account of the Agriculture of Cheshire, that every dairy should be provided with a regular sweating-room; as when cheese is made, there is certainly a specific time when its contained air and juices incline to fermentation; and that the natural tendency should, at that particular time, be suffered. But that in the present mode, the whole is left to chance; and that at the very period, probably when a cheese is beginning to ferment, the weather becomes suddenly cool, or changed in other respects; which, if the process be then checked, the enclosed air becomes putrid, especially if the cheese has been ill made, and the next fermentation is really putrefactive.

SWEATING-Sickness, in Medicine, a febrile epidemic disease of extraordinary malignity, which prevailed in England at different periods, towards the end of the 15th and beginning of the 16th centuries, and which spread very extensively in the neighbouring countries on the continent. It has been described by various writers under the names of ergotism, ephemerain, ephemeris furtidoria, hydropsitus, and hydoproseps. It appears from their accounts to have spared no age or condition, but to have attacked more especially persons in high health, of middle age, and of better rank and condition. The invasion of the disease was exceedingly sudden, and was marked by the affection of some particular part, producing the sensation of intense heat, extending through the limbs, and afterwards diffusing itself over the whole body. This was immediately followed by profuse sweating, which generally continued more or less through the whole course of the disease, and was attended with intractable thirst. Extreme reflexions, delirium, nausea, cardialgia, and an irresistible propensity to sleep, characterized its progress; together with great prostration of strength, producing frequent fainting, and irregularity in the action of the heart, which sometimes palpitated violently, while at other times the pulse was weak and fluttering. In this way the patient was carried oft frequently in one, two, three, or four hours from the eruption of the sweat. Those more especially who bore their sufferings with impatience, and who sought relief from the face of a brest, by which they were tormented, by exposing their bodies to the air, or even by putting their arms out of bed, were often suddenly struck with death. The sweat, when promped, is represented as being unprofitably clammy, as well as abundant, and as having a very strong and peculiar fetid odour. The violence of the attack generally fubsides in fifteen hours, yet the patient was not out of danger till the expiration of four-and-twenty hours.

The history of the rise and progress of this singular and formidable disease constitutes one of the most curious articles in the annals of medicine. Its origin is involved in a good deal of obscurity; and among various explanations, reasoning, concerning the mode in which it was propagated, is to be met with even among the most authentic authors who describe its ravages. It seems, however, to be generally admitted, that it first appeared in the army of the earl of Richmond, afterwards king Henry VII., upon his landing at Milford Haven, in 1485; and that it soon spread to London, where it raged from the beginning of August to the end of October. Whether the troops, which were foreign soldiers, levied by the earl of Richmond, brought the disease with them from the continent, or whether the contagion was generated in the crowded transports, on board of which they were embarked, it is impossible, amidst the deficiency of evidence, to determine. It may readily be supposed, however, that a highly malignant contagious disease might have been generated under the circumstances, especially as this body of troops is described by a contemporary historian (Philip de Comines) as most wretched he had ever beheld; collected, it is probable, from jails and hospitals, and buried in filth. The general opinion at the time, however, certainly appears to be, that it arose from some peculiar state of the atmosphere, and was propagated by contagion; but no writer has distinctly pointed out the connection of this, or of other epidemic, with a specific condition of the air, nor testified any peculiarity in the circumstances attending its appearance, or subfequent return.
The sweating-sickness broke out in England four different times after this, but at unequal intervals. The summer season was always the period of its commencement, and it continued rife from three to five months. It appeared during the summer of 1506; and again in 1517, from July to the middle of December; and it raged with peculiar violence, proving fatal in the course of three hours; extending its havoc to many of the nobility, and carrying off, in many towns, half the inhabitants. Its next recurrence was in 1526; at which time, though it was somewhat less fatal, many of the courtiers of Henry VIII. fell victims to it, and that monarch himself was in danger. Bellay, bishop of Bayonne, then ambassador in England, who was affected with it, reports, that of 40,000 persons attacked with it in London, only 2000 died. The last time that it visited England was in 1551, when its fatality was so great, that in Westminster 120 died of it in a day, and, among others, the two sons of Charles Brandon, both dukes of Suffolk. In Shrewsbury, particularly, according to the testimony of Dr. Caius, who resided in that city, 900 died within a few days. The disorder had also, in the mean time, been decimating many parts of the continent. In 1549 it first shewed itself in Holland, and thence spread to the Netherlands, and to Germany, destroying a great number of lives. It is stated to have interrupted a conference at Marburg between Luther and Zwinglius, about the eucharist. From the description which Wierus has given us of this epidemic, as it appeared in Germany, it seems to have commenced with a violent cold shag and shivering, which continued half an hour or more, accompanied with great pains in the region of the diaphragm and groin, and the other symptoms already mentioned as characterizing the disease, when observed in England. Swelling and redness of the hands at the beginning of the attack, and vomiting of black blood or bile, are also noticed by this author in particular. Erazmus, an eye-witness of its devastations, describes it in very forcible terms, "vium eft ex amne Phlegetoneo emphium hoc malum."

For a long time physicians were at a loss how to treat this new and singular malady. The fatal effects of exposure to cold, however, suggested the propriety of accumulating heat round the patient, with a view of stimulating the sweat, which appeared to manifestly be a critical discharge. The moment a person was seized with the symptoms of the disease, he was to lie down immediately in bed, without taking off his clothes, and to be completely covered, all but the face, with bed-clothes; in which situation he was to remain perfectly still, not flitting a limb, if possible, nor putting a hand out of bed. He was enjoined abstinenence from food during the whole twenty-four hours, and even from drink the first five hours: then a little ale or beer, or wine and water, was to be given in small portions, and sucked through a spout, the patient still lying in the same posture. At the expiration of about fourteen hours, the bed-clothes were gradually to be removed, and the sweating reformed; and after it was quite over, proper food was to be given to recruit the exhausted strength. This was the process, when the sweat flowed spontaneously: when this was not the case, attempts were made to excite it, such as by dry and warm friction, wine, aromatics, vinegar whey, China root, and other sudorific medicines. By this method of practice, actively purified, and properly adapted to the circumstances, we are told that the disease, though so fatal when neglected or mismanaged, was got over with a tolerable certainty of success; so that, according to the observations of lord Bacon, who has given us a short account of it in his "History of Henry VII.," it might be looked upon "rather as a surfeit of nature, than obstinate to remedy." Great stress is laid by some physicians on the danger of indulging the propensity to sleep, which accompanies the paroxysm. "If they were suffered to sleep," says Cogan, "commonly they fwooned, and so departed, or else immediately upon their waking." (Haven of Health, p. 262.) It appeared, however, from the testimony of the continental physicians especially, that much harm, and frequently fatal consequences, arose from the extremes to which the hot regimen was carried.

Dr. Willan, in his publication on cutaneous diseases, has thrown out a suggestion concerning the origin of this affection, which he supposes might have been owing to some diffease or depravation in wheat, or to some noxious vegetable growing with it in particular situations. This seems to have been suggested by some analogy to be tried between the fatal epidemic, called feu facré, feu St. Antoine, mal des arènes, &c. which is supposed to have originated from eating rye damaged by a parasitic plant, constituting the disorder in corn termed by the French rye. This opinion appears, however, to be untenable, and has been ably combated in a paper in the Edinburgh Medical Journal, vol. iv. p. 64.

The books from which original information may be collected on the subject of this article are the following: "A Boke or Confess against the Difease commonly called the Sweat, or Sweating-Sicknes, made by John Caius, Docthe in Physic," 1552, 12mo.; which was afterwards revised, enlarged, and put into a more scientific form, by the author, and published in Latin, in 1556, under the title of "De Ephemera Britannica:" a short account by lord Beaumont in his "History of Henry VII.," Joh. Wierus, "De Sueco Anglico," C. V. Dubrégol, "De Peste," Erasimus, in "Epistolae ad Carolum Utenheimi," Febres, "Schol. Observationes," vi. 8.; Severntus, iv. 15.; Thomas Cogan's "Haven of Health!" "Lord Bacon's Relation of the Sweating-Sicknes examined, &c. by Henry Stubbe, Physician at Warwick," 4to. Lond. 1671; J. Fortis, "Ephemera Anglica Pefilenes."
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the Norwegian Alps to the limits of Russia about 600. The contents in square miles have been computed to be 208,913; and the inhabitants, supposing some years ago to have been 2,077,345, must have been 14 to the square mile, including Swedish Pomerania, estimated at 1440 square miles, and 103,545 inhabitants. The population of Sweden is very disproportioned to the extent of its territory; a circumstance which is attributed partly to the mountainous nature of the country, and partly to the severe climate of the northern districts. Accordingly Swedish Lapland is supposed to contain no more than 7000 inhabitants. Although geographers are very much disagreed in their statements of both the extent and population of this kingdom, its population at present is thought to exceed 3,000,000. According to the information communicated to Mr. Coxe by M. Wargentini, the rate of population, in the annexed years, was as follows: viz.

<table>
<thead>
<tr>
<th>Year</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
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<tr>
<td>1752</td>
<td>1,045,532</td>
<td>1,170,017</td>
<td>2,215,549</td>
</tr>
<tr>
<td>1776</td>
<td>1,284,987</td>
<td>1,386,962</td>
<td>2,671,949</td>
</tr>
<tr>
<td>1781</td>
<td>-</td>
<td>-</td>
<td>2,797,000</td>
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By this statement it appears, that the country has been gradually recovering from that exhausted state, to which it was reduced by the wars of Charles XII.; and that within the interval of 30 years, the number of inhabitants has increased 551,961, or a fifth part of its population in 1781; and as it has been upon the increase, it is supposed that it must now exceed 3,000,000. The nobility are supposed to include 2500 families, and the classes of peasants to comprehend 2,000,000.

The manners and customs of the Swedes, in the higher ranks, resemble those of the French; and the peasants exhibit such a degree of vivacity and address, as to have acquired the appellation of the French of the north. The complexion is less fair than that of the inhabitants of northern latitudes, and in some provinces it has a cast of brown. The men are commonly robust and well-formed, and the women slender and elegant. Their attachment to luxury is, in some measure, compensated by their love of hospitality. As trade and manufactures have made no great progress in this country, the peasants in general make their own furniture and garments. The natives of the western province of Dalecarlia retain many customs, and are distinguished for their probity and courage; but for any remarkable peculiarities of manners we must have recourse to Swedish Lapland. The language of Sweden is a dialect of the Gothic, being nearly akin to the Danish, Norwegian, and Icelandic. However, in the south of Sweden, some German and French words have been adopted; whilst the Dalecarlian on the north-west is esteemed a peculiar dialect, because it retains more of the ancient words and idioms. The Swedish language is sufficiently honorific, if the pronunciation were more emphatic. Mr. Coxe, during his progress through that kingdom, was struck by a surprising resemblance between the English and Swedish languages, not only in single words, but in whole phrases. To him the Swedes appeared as if they had been talking broad Scotch; and he thinks it probable, that the Scottish mode of speaking is the same as was formerly used in England, and that, while we have gradually softened our original pronunciation, the Scots have retained theirs. It is observed that the resemblance between the Scotch and Swedish is greater than between the Swedish and English, both in words and pronunciation; and that several obsolete Swedish words are very common in Scotland.

With respect to the similarity between the Swedish and English tongues, we may remark that they are both dialects of the Teutonic or German; and if in pronunciation they resemble each other more than their original stock, it is owing to this circumstance, that we are descended from the Swedes and Danes, whose languages are only different dialects; and the old Saxons, which gave rise to the English, was probably first introduced into our island by settlers, or invaders, from these northern kingdoms.

With respect to antiquity of literature, Sweden cannot vie with Denmark, Norway, or Iceland; but in modern times the Swedes have distinguished themselves in many departments of literature and science. It is needless to mention St. Bright, who flourished in the 14th century, and whose prophecies were published in Latin, or John and Olaus Tegnus, who retired to Rome, when the bishops were expelled from the kingdom by Gustavus Vasa; because Swedish literature can hardly be said to have dawned till the middle of the 17th century, when queen Christina invited Grotius, Descartes, and other learned men, to fow the seeds of literature, which gradually prospered under the reign of Charles XI. The names of Linnaeus, Wallerius, Cronstadt, Bergman, &c. in natural history, are well known. Sweden may also boast of other persons, who have distinguished themselves as historians, orators, and poets; and of academies which have encouraged the diffusion of literature and the sciences. Sweden has three universities, viz. those of Upsal, Lund, and Albo, and twelve seminaries for the education of youth, called "Gymnasia," of which six were founded by Christina. In every large town there is also a school, maintained at the expense of the crown, in which boys generally continue to the age of eleven, when they are sent to the Gymnasia, and from thence, at sixteen, to one of the universities. In the Gymnasia, and many of the greater schools, the Greek, Latin, and Hebrew languages are taught. The bishops inspect the seminaries and schools of their respective dioceses, in which they are bound to reside. The chief cities of Sweden are Stockholm the capital, Upsal, Gothenborg, and Carlserna; which see respectively. The improvement of the country by inland navigation has of late become an object of laudable attention. (See CANAL and TROLLETTA.)

Although the manufactures of Sweden are not numerous, yet they are not wholly neglected. They are chiefly those of iron and steel, of copper and brass, together with those of cloth, hats, watches, and fail-cloth, and the construction of ships. Many perfumes are employed in the manufactures of wool, flax, and cotton. But the chief article of export is iron. The commerce of Sweden is chiefly concerned in the exportation of its native productions, iron, timber, pitch, tar, hemp, and copper. Herrings also furnish an article of exportation; and the Swedish merchants import from their own island of St. Bartholomew, and from China, commodities which they afterwards transfer to other nations. The chief article of import is corn of various kinds, together with hemp, tobacco, sugar, coffee, drugs, flax, wines, &c. From a table of commerce published by Mr. Coxe, it appears that the balance in favour of Sweden in 1781, was 350,437L.

As the kingdom of Sweden is situated between the 10th and 50th degrees of E. long., and the 5th and 70th degrees of N. lat., the winters are long, cold, and dreary; and the summers are short, and alio hot, on account of the reflection of the mountains and the length of the days. The transition from fertility to luxuriant vegetation is in this, as it is in similar climates, sudden and rapid. The dreariness and darknes of winter are relieved by the duration of twilight and moonlight, by the reflection of the snow, and by the aura
SWEDEN.

aurora borealis. No country can be diversified in a more picturesque manner, with extensive lakes, large transparent rivers, winding streams, bold castriata, gloomy forests, verdant vales, suspended and cultivated fields, than Sweden. Although the soil is not very propitious, it is cultivated with skill and industry; and in the south of Sweden, such has been the progress of draining, and other agricultural improvements, that a sufficient quantity of wheat may be raised for the supply of the kingdom. Its rivers are numerous, and the largest of them are in the native language denominated äker or äf. The most considerable, such as the Göta, flow from lakes, and have a short course; others assume the form of creeks, and outlets of lakes. The Motlidae: and the first river of considerable course is the Dahl, consisting of two streams, the eastern and western, which rise in the Norwegian Alps, and after a course of about 260 British miles, enter the gulf of Bothnia, about 10 miles E. of Gjesle, presenting not far from its mouth a celebrated castriata, little inferior to that of the Rhine at Schaffhausen; the breadth of the river being near a quarter of a mile, and the perpendicular height of the fall between 30 and 40 feet. Further northwards, and especially in Swedish Lapland, there are many considerable rivers, that rise in the North Alps, and after a course of about 300 miles, discharge themselves into the gulf of Bothnia. The Torne, springing from a lake of the same name, and receiving the Kengis, and other considerable rivers, joins the northern extremity of the Bothnia gulf, after a course of about 300 British miles. Few countries can rival Sweden in number and extent of its lakes: such are the Wenner, the Wetor, the Meier, &c. which see respectively. The most considerable lake in Finland is that of Pejond or Pejans, about 80 miles long, and 15 broad, from which flows the river Kymmen. The lake of Salmo to the E. is a mere expanse, estimated at about 150 British miles in length, by 25 at its greatest breadth; which flows into the Ladoga, by the seifly current of Woxen, a vast castriata about a mile from its mouth.

The chief mountains of Sweden are found in that elevated chain which divides this country and Swedish Lapland from Norway. The highest mountain of this chain is supposed to be Swuchu, of acompact flaty freeone, but having towards the west mafoes of a different nature; and where it inclines to the lake of Finsmad, there are apartments that rise even by the fose taphorns in width, and other a depth, not exceeding in length from two to three hundred ells. Bergman also mentions the high mountain of Moeforen, near the same lake, as being formed of a puddingstone, conflagint of balls of free-stone, with a few of hornblende and lime-stone, united by a fandy cement. The calcareous mountain of Rattvijk is extinguished by him to be 6000 feet high above the sea; and he observes, as a sanguinarity, that upon this mountain, and that of Roddougb, are found vast blocks of reddish felspar, mingled with quartz and brown mica. On the mountains of Samund, there are also numerous fragments of transparent felspar, mingled with quartz and mica. In the centre and south of Sweden, the red granite becomes very common; but in Weftor-Gothia, the mountains are often of trap. The foreka of this kingdom are numerous; and Dalecarlia especially, abounds with those of beech, poplar, mountain asf, pine, and fir; and the lakes of Sweden are generally filled with wood to the margin of the water. But our limits will not allow us to give a detail of the various trees and plants that are to be found in this country. The horses, good and after circuit of mony small, but spirited, and are preferred, by lyving with out litter, from many diseases. The cattle and sheep pre-
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by continual encroachments, carried to such an exorbitant height, as justly to excite the fears and indignation of the three other orders. Charles XI. artfully availing himself of this dissatisfaction, obtained from the states a formal grant of absolute sovereignty, which quietly devolved upon his son Charles XII. Upon his decease, Charles Frederic, duke of Holstein, son of his eldest sister Hedwig, ought, by the law of succession, to have ascended the throne; but the Swedes conferred the crown on Ulrica Eleonor, the youngest sister of Charles XII. Ulrica purchased her election by raising the limitations of prerogative imposed by the states; and her husband, Frederic I., in whose favour she resigned the crown, secured their concurrence by similar stipulations.

The new form of government established at this juncture, consisted of fifty-one articles, all tending to abridge the power of the crown, and rendered the Swedish sovereign the most limited monarch in Europe. The supreme legislative authority, and the power of declaring war and making peace, reposed in the states of the realm, which regularly assembled every fourth year, and could only be dissolved by their own consent. During the recess of the diet, the executive power was vested in the king and senate; but as the king was bound to abide by the opinion of the majority, and possessed only two votes, and the casting voice in case of equal suffrages, he was subordinate to the senate, and could be considered in no other light than the senate. The king enjoyed the mere name of royalty; he was only the officiable instrument in the hands of one of the two great parties which divided and governed the kingdom, as either obtained the superior influence in the diet. The great defects in this new form of government originated from frictions between the sovereign and subjects, on one side to increase, on the other to depref, the royal prerogative; until Gustavus effected the revolution of 1712. In consequence of this revolution, the whole executive power is virtually vested in the king; for though it is said to be entrusted to him conjointly with the senate, yet as he appoints and removes all the members of that council, and in the administration of affairs only sifts their advice, without being bound to follow it, he is absolute master of the senate. The king has the command of the army and navy, but is not charged with the despatch of the state affairs by all commissions; he likewise nominated to all civil offices. He has the sole power of convening and dissolving the states, and is not obliged to assemble them at any fatted period; he has rendered many of the taxes perpetual, enjoys a fixed revenue, and has the disposal of the public money.

Such are the prerogatives which are annexed to his crown; but however enormous they may appear, especially when compared with the slender degree of authority possessed by the throne before that period; yet, says Mr. Coxe, they by no means amount to despotic. The two great features, which essentially distinguish an arbitrary from a limited monarch, are the right of enacting and repealing laws, and the imposition of taxes without consent of the subject; neither of which are exercised by the king of Sweden. The legislative authority resides jointly in him and in the states; and the 40th article specifies "that the king shall have no power to make new laws, without the knowledge and assent of the states; nor abrogate an old one received formerly." Concerning the imposition of taxes, it is stipulated, that the king shall not levy money without the consent of the states, except in the case of actual invasion; but at the conclusion of the war he shall be obliged to summon them, and the new taxes shall be abolished. In addition to these two important restrictions, he cannot declare war, nor alter the coin, without their concurrence, and if called upon by them when convened, is obliged to account for the expenditure of the public money.

Though the king is subject to these material limitations; yet, as his ordinary revenue is perpetual, and the meeting of the states depends solely upon his pleasure, he may, if he please, govern without control, so long as he requires no additional subsidies. But as he cannot enact laws, declare war, or levy taxes, without consent of the diet; emergencies must occur, which may render it necessary to convene that assembly; when grievances may be redressed, and breaches in the constitution repaired.

Whatever be our opinion concerning the nature of the government subsisting after the year 1772, it is unquestionable that by the Act of Union, &c. in 1780, the constitution became an absolute monarchy; the sovereign having arrogated not only the rights of peace and war, and the administration of justice, but the imposition of taxes, without the consent of the diet, which cannot deliberate upon any subject till it be proposed by the sovereign. The diet consists of nobles and landed gentlemen, clergy, burgesses, or representatives of towns, and members of the council. Each of the four states has a speaker: the archbishop of Upsal being always the speaker of the clergy, while the king nominates the others. The diet of 1780 consisted of 49 counts, 136 barons, 188 knights, 396 gentlemen, 51 ecclesiastics, 94 burgesses, and 165 deputies of the order of peers. The revenue of Sweden is computed at about 14 million fylsterling; which is equalled by the expences of government. The revenues are chiefly drawn from the rents of the royal demesnes, part of the great tithes, a poll-tax, duties on exports and imports, on mines and forges, on distilled spirits, on hatchments, pensions, and places, tax on chimney, and monopoly of salt. The national debt amounts to little less than 10,000,000 fylsterling. The Swedish army consists of national troops, and of foreign infantry; the latter being computed at about 12,000. The total amount of the army may be about 48,000: and the soldiers are brave and hardy, and actuated by the former fame of the Swedish arms.

In order to raise the Swedish army, the kingdom is divided into districts, which are respectively bound to furnish and maintain a certain number of troops. Each holder of a certain quantity of crown land, called a hemman, provides a soldier, affords for his maintenance a small portion of ground, a cottage, and a barn, and allows him 100 copper dollars, or 1 l. 7s. 8d. per annum, a suit of coarse clothes, and two pair of shoes. During the absence of the soldier, either with the army in time of war, or during the annual reviews, or when he is employed in the service of government, the landholder cultivates his ground for the subsistence of his family, and, when he is present, may call upon him to work at the rate of the common wages bestowed on labourers. On the death of the soldier, his widow and children cede the ground and house to his successor, whom the landholder is bound to provide within the space of three months, on pain of being fined.

With respect to the cavalry, a certain number of hemmans are joined to furnish a man and horse fully equipped, and maintain them both.

Each province being divided into a number of hemmanns sufficient to support a regiment; the smaller provinces furnish the regiments of infantry, and the larger those of cavalry. The estate appropriated to the colonel is situated towards the centre of the province, and of the grounds assigned to his regiment; that of the captain in the middle of those belonging to his company; and in a similar gradation to the corporal.
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In every year, either before or after harvest, when the peasants are least employed, the companies of each regiment are separately assembled for a fortnight or three weeks. The landholder is obliged to transport the man and his baggage to the place of rendezvous, and maintain him during his stay at the review. Befide these annual encampments, once in three years a general review of each regiment takes place. The men are also constantly exercised on Sundays, after divine service, in small parties, and in larger corps for some time before the encampment, but particularly in spring. If, in time of war, these troops march out of the country, the crown receives the usual contributions from the landholder, and provides the soldiers with clothes, provisions, and pay.

The Swedish fleet, which in 1792, consisted of 30 ships of the line, suffered so much by the naval operations of that year, that it cannot now reckon half that number. In the Baltic, which abounds with low coasts and isles, galleys of a flat construction are found more serviceable than ships of war, and of course great attention is paid to the equipment of such by Sweden as well as by Russia. Prior to the late revolution in France, Sweden had remained a faithful ally of that kingdom, which excited against her many enemies in Germany. Of late this alliance seems to have been sacrificed to a more useful connexion with Denmark and Prussia, which alone can guard the north of Europe from the progress of the Russian preponderance. The disorder of the finances unites with many other causes of discontent, both among the aristocracy and peasantry, to render the power of Sweden little apparent in the political balance of Europe.

In Sweden there are four superior courts of justice, called hof-rett: at Stockholm for Sweden Proper, at Jonköping for the kingdom of Gotland, at Abo for South Finland, and at Vaasa for North Finland. No sentence of death passed by the inferior courts can be executed, unless ratified by these tribunals.

The usual modes of execution in Sweden are beheading and hanging. Every criminal capitally convicted is indulged with the privilege of petitioning the king; he either complains of unjust condemnation, and demands a revial of the sentence; or, if he confesses his guilt, may implore pardon, or a mitigation of punishment. So mild are the penal laws, that several offences, which in other countries are considered as capital, are chastised by whipping, condemnation to bread and water, imprisonment, and hard labour; more than 72 strokes of the rod are never inflicted; nor is a criminal sentenced to bread and water for more than 28 days.

Many flagrant abuses in the courts of justice have been reformed and corrected by the king. In all cases of high treason, previous notice must be sent to the crown before any court can commence an inquiry, and an ordinance has put a stop to many frivolous and vexatious accusations. Before the ascension of Gustavus III., it was common for persons indicted, but not convicted, of crimes, to suffer an imprisonment of several years without being tried; but, by the abolition of many tedious forms, every criminal is arrested within a short period after commitment, the good effects of which alteration require no comment. He mainly increased the salaries of the judges, and conferred their share of the fines inflicted by their decision to other uses; by this judicious regulation he greatly lessened the corruption and injustice which prevailed in those tribunals; for the scanty incomes of the judges exposed them to bribery; while a share in the fines rendered them interested in conviction the criminal. The king also promoted the rights of humanity, by supressing, in 1773, the cruel and absurd practice of torture, which was employed for the purpose of obtaining a confession of guilt.

One excellent regulation in the courts of Sweden deserves to be mentioned, and adopted in all countries; a criminal is tried without expense to the plaintiff or defendant. The prosecution denounces a person suspected of guilt to the king's officer of justice, who carries on the proceed at public charge.

In Sweden there are four orders of knighthood: I. The order of the Seraphim (see Seraphim), or the blue ribbon, which is appropriated to perfons of the first rank; it admits only 24 members, exclusive of the royal family and foreign princes. II. The order of the Sword, or the yellow ribbon, for the officers of the navy and army. There are three classes of this order: 1. Commanders of the Great Cross, who wear the ribbon over the shoulder, and a star on the cost. 2. Commanders, who wear the ribbon in the same manner, but without the star. Each of these classes contains 24 members. 3. Knights, who wear the small cross pendant from the button-hole. The number of the star is indefinite, but generally amounts to above 1000. III. Pol Star, or the black ribbon. Of this order there are two classes: 1. Commanders, who wear the great cross pendant round the neck; there are 24 of this class, exclusive of four to be added for the bishops. 2. Knights, who wear the small cross pendant from the button-hole, are, exclusive of foreigners, 48; and are to be added for the bishops. The order, before the institution of the following order of Val, was conferred on men of letters. IV. The order of Val, or the green ribbon, established at the coronation of Gustavus III., is divided into three classes: 1. Commanders of the Great Cross, who wear the ribbon over the shoulder, and the star on the cost. 2. Commanders, who wear the ribbon over the shoulder, without the star. 3. Knights, who wear the ribbon over the neck. This order is conferred on persons who have distinguished themselves in agriculture, commerce, the arts, and sciences.

The gold coins of Sweden are double, single, and half ducats. The single ducats are to pass for 1 rigsdaler 45 skilling specie, or 11 daler 24 ore silver, or 31 daler 8 ore copper. The copper coins are single and double flatts, at 1 and 2 ore silver, or 3 and 6 ore copper, and rundbycken of 1 ore copper, and also half rundbycken of 96 double flatts, 192 single flatts, or 576 rundbycken, are to pass for 1 specie rigsdaler; but in large payments, no person is obliged to take more copper coin than the value of half a rigsdaler. As the Swedish ducata weighs 33 English grains, and contains 524 grains of fine gold, it is worth 0s. 2d. Sterling in English gold coin; but in Sweden this ducat passes for 94 skilling, which are worth only 0s. 1d. in English silver coin. The following is the report of an average alloy made on a quantity of Swedish dollars at the London mint, by order of the bank of England: "weight of 1000 dollars 1871½ oz.; average weight of each, 18 dwt. 17 gr.; average fineness 14½-dwt. more than English fineness." Hence the value is 4s. 6d. in English silver coin; but the dollar falls more, in proportion as the market price of silver in England exceeds the mint price. See Money and Rigsdollar.

The smallest denomination of weight in Sweden is the sk, which is the same as the as of Amsterdam, where 10000 skills are equal to 7417 grains, English Troy weight. The mark for weighing gold and silver, called "Silver-march," is 4384 skills = 3352 grains, English Troy weight; hence so much mark = 271 ounces Troy. In apothecaries' weights the pound is 7416 skills = 5400 grains Troy: hence 1 sk.
**SWEDEN.**

There are four other weights used in Sweden for different purposes: their proportions to each other, and to English weights, appear in the following table.

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<tr>
<td>1 Skalpund, =</td>
<td>1 Mark Berga-Wigt, or Miners’ Weight =</td>
<td>Os. Dr.</td>
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<tr>
<td>8848</td>
<td>6564</td>
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<tr>
<td>1 Mark Uppblada-Wigt, or Inland Town Weight =</td>
<td>7821½</td>
<td>58014</td>
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<tr>
<td>7407½</td>
<td>5724</td>
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<tr>
<td>1 Mark Stapfellads Metal Wigt, or Sea-port Town Weight for Iron =</td>
<td>7079½</td>
<td>5750</td>
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The pound visuable-wigt is divided into 32 lods, or 128 quintains: the mark of all the other weights is divided into 16 lods, or 64 quintains: 20 lbs. visuable-wigt make 1 lispund, and 20 lispunda 1 skippund: 32 lbs. vis. wigt make a ron: 120 lbs. a centner: and 16'7½a. a wangi.

Corn, and other dry commodities, are measured by the tunna. The tunna is divided into 2 spanna, 4 half-spanna, 8 fjerdinger, 32 kappar, 56 kannor, 112 flop, 448 quarters, and 1792 ort. With the allowance for good measure of 4 kappar for every tunna of wheat, rye, barley, oats, and peas, and 6 kappar for every tunna of malt, and of 2 kappar for salt or lime, a tunna of corn contains 65 kannor, of malt 66¼ kannor, and of salt or lime 59½ kannor.

The common tunna of 32 kappar measures 8940 English cubic inches, and therefore contains 4 Wincheffer bushels, and 5 quarts.

The liquid measures are as follow: the oxhufvud = 1½ spanna = 3 emer = 6 akare = 90 kannor = 180 flop = 730 quarter = 2880 jumfrur: 2 oxhufvud = 1 pipe, and 2 pipes = a fuder. The tunna of liquids or soft substances, and also of flour, meat, and fish, must contain 48 kannor, and a tunna of pitch or tar may contain 1 flop, or half kannor, less.

The oxhufvud measures 14.281 English cubic inches, and therefore contains 62.5 English wine gallons. The kannor, both for dry and liquid measures, contains 1594 English cubic inches; hence 100 kannor = 69¾ English wine gallons.

The Swedish foot = 1.316 French lines, or 11½ English inches, and 40 Swedish feet = 39 English feet. A Swedish ell = 2 Swedish feet; a fathom = 3 ells; and a rod = 8 ells, or 16 feet. A Swedish mile is 6000 Swedish fathom = 11,700 English yards; so that 11 Swedish miles are as 1 English mile. It is a degree of the meridian, fixed in 1820, in N. lat. 66° 20' 10" by M. Swanberg, is = 59706.15 English miles. A Swedish square foot contains 13.64 English square inches; a Swedish square rod = 27 English square yards; and a Swedish square mile = 44 English square miles. A Swedish tunneland or acre = 56,000 Swedish square feet, or 5900 English square yards, i.e. 1 acre and 35 perches, English statute measure; and hence 32 Swedish tunneland = 39 English acres.

A half of pitch, pottash, Luneburg salt, or beer, is 12 tunna of tar, or train-oil, 13 tunna of Spanisch and French salt, 18 tunna of fish, 12 tunna, or 12,000 herrings; 1 hemp, flax, cordage, tallow, or hops, 6 kippunds, or 120 lipfunds, answering nearly to a ton avoirdupois. A wall is 20 kafts, or 80 pieces. Stockholm and the other cities of Sweden exchange with London at 4 right-daler 15 skilling, more or less, for 1l. sterling, at 75 or 90 days.

Theulance is reckoned at one month after flight; six days of grace are allowed for the payment of bills, in cases of necessity, but a person who wishes to preserve his credit, must not claim any days of grace, but pay his bills on the day when they are made payable. The paper currency of Sweden, which is very extensive, is of two sorts, viz. banco and riksgold. The former is issued by the national bank, and the latter by the riksgold bank, which is under the direction of government. Banco is 50 per cent. better than riksgold: that is, two dollars of the former are worth three dollars of the latter. Banco is a legal tender, and has been declared by royal authority the national currency. Bank notes are issued in great variety, and as low as 3ths of a dollar. Riksgold is current in all payments.

Of the history of Sweden we can give only a brief and imperfect sketch within our prescribed limits. The first population of Scandinavia seems to have consisted of Finns, who probably about 7 or 8 centuries before the Christian era were supplanted by the Goths. (See SCANDINAVIA and GOTHS.) The southern parts of Scandinavia were inhabited by the Situnes in the time of Tacitus; and Ptolemy mentions five or six tribes, among which are the Gute of Gothland, as inhabiting the portion of Scandinavia known in his time. Jormander, in the fifth century, described Scania or Scandinavia, and mentions various nations by which it was occupied. The fabulous or traditional history of Sweden commences about the year of Christ 520. Before the eighth century it contained many provincial sovereigns, of whom the king of Upulf was chief. As cultivation spread, and deferts were converted into fields, new kingdoms arose; and of these Swoore esumeers nineteen. The king of Upulf subjected these inferior rulers, and Ingialld, who perished in the invasion of Ivar Vidfadam, destroyed by treachery 12 of the petty kings, and the king of Upulf received tribute from the, called on that account tributary kings. But these subordinate rulers sometimes anadied so much wealth and power, as to be more powerful than the superior lord.

Sweden had not a very extensive population till after the beginning of the eighth century. In the preceding age it was so full of woods and deferts, that it required many days journey to pass over them. The father of Ingialld exerted himself to convert many heaths and forests into arable land. He made roads through territories previously unexplored, and by his skill and industry, great extents of country were adorned, for the first time, by the cottages, corn, and people of a flourishing cultivation. This continued, however, was still insufficiently peopled, that Olaf, the son of Ingialld, flying from Ivar in the eighth century, found the country from the W. of the kingdom of Upulf to the Senner or Wener lake, an uninhabited forest. He cleared, by the axe and fire, the regions about the river, which runs into the lake; and the province and kingdom of Vermaland rose under his auspices. It was not till the ninth century that Jamtia and Hellingia, the two northern provinces of Sweden, received a permanent colony. Sweden was for a long time a favourite prey to the pirates of Denmark and the Baltic. In the eighth century (about A.D. 760) the Upulf kingdom was conquered by Ivar Vidfadam, the little potentate of Scania, whose father was one of the chiefs de-
stroved by Ingialld. Upal afterwards continued to gain increasing power and preponderance. From the year 760 there is an obscure period till the reign of Birn i A.D. 321, commemorated, with his immediate successors, by Adam of Bremen. Jægerbrong, one of the bold native historian, divides the ancient kings into the Yngling race, the most ancient according to traditional records, and terminating at the conquest by Ivar Vidfadne, who was succeeded by his grandson Hareld Hilddat, and his great grandson Sigurd Ring, and the race of Sigurd derived from another branch. In the reign of Olaf III. A.D. 1000, Sweden was partially converted to Christianty, but Paganism was not finally abandoned till the reign of Ingii the Pious, A.D. 1066, whole father, Stenkl, is regarded as the founder of a new dynasty, though he sprung from the house of the Sigurd. At this time the crown, which was before hereditary, became elective. The Swedes, discontented with their king, Albert of Mecklenburg, elected, A.D. 1888, as their sovereign, Margaret, heiress of Denmark and Norway. Thus ended the Fölkung race, whose accession had taken place about the middle of the 13th century; and by the celebrated treaty of Calmar, A.D. 1370, the three kingdoms of the north were supposed to be for ever united. But after the death of Margaret, in 1412, the Swedes began to struggle for their liberty, and in 1449, Karl or Charles VIII. was elected king of Sweden. However, having affaile the property of the church, he was forced to leave the kingdom in 1457, but was afterward restored. The struggles between Denmark and Sweden continued until the cruel and tyrannic reign of Christian II., king of Denmark, Norway, and Sweden; called the Nero of the North. His conduct incensed the whole nation against him; and after a contest which forms one of the most interesting portions of modern history, Gustavus Vasa delivered his country from the Danish yoke, and under him Sweden recovered its independence. The revolt may be considered as having commenced when Gustavus appeared at Mola, in Dalälard, A.D. 1520, and complete three years afterwards, when he entered Stockholm in triumph. Diff cered with the power of the clergy, which had repeatedly subjugated the kingdom to Denmark, this great prince, A.D. 1527, introduced the reformed religion, and died in his 70th year, September 1560, after a glorious reign of 37 years. Austria, Spain, and the other Catholic kingdoms, having conspired to extirpate the Protestant religion in Germany, Gustavus Adolphus, whose reign lasted from A.D. 1611 to 1632, and who exhibited a model for heroes and kings, was invited to assist the reformed, and carried his victorious arms to the Rhine and the Danube. Christina, the daughter of Gustavus, was very young at the time of her father’s death, but when she succeeded to the throne, she shewed herself worthy of it as long as the wife Oxen- tiern was Her miniter and confidential counsellor; but did regarding the counsel of that respectable veteran, the affection of her subjects abated; and fatigued with the cares of government, and having formed a kind of classical attachment to Italy, she abandoned the Swedish throne, her country, and her religion, and retired in 1654. Charles Gustavus, or Charles XIII., was requested to succeed her, and the states confirmed this choice. The northern powers took up arms against this kingdom, and the career of Charles was terminated by death soon after the repulse of Charles from the siege of Copenhagen. The peace of Oliva, concluded in 1660, soon after his death, restored tranquillity to the North. Charles XI. was mediator at the peace of Rywick in 1657, and died in that year. At this time the arts and sciences flourished, and the power of the kingdom was carried to its height. Charles XII. next assumed the reins of government, and by his frantic conduct, and notwithstanding all his conquests, sunk Sweden into a state of political humiliation, and it was afterwards regarded as little better than a province of Russia. His death, in 1718, was succeeded by a variety of diftaters, and by revolutions of territory in Russia, until at length, at the peace of Abo, in 1743, Sweden ceded part of Finland; and Adolphus Frederic, of the family of Holstein-Gottorp, and descended by the female line from the family of Vasa, was declared successor to the throne. The revolution under Gustavus III. in 1772, though perhaps upon the whole beneficial to Sweden, prepared the way for a despotic government. In 1792 this prince was affianced at a ball by a nobleman, of the name of Ankerforn, a captain of the guards, who con- fessed that he was the performer who had endeavoured to deliver the country from a master and a tyrant. Gustavus IV. was deposed in 1809, and succeeded by his uncle Charles XIII. duke of Sudermania. Subsequent events are of little general importance. Coxe’s Travels. Pinkerton’s Geog.

SWEDENBORCH, EMANUEL, in Biography, the son of a Swedish bishop, was born at Stockholm in the year 1689, and educated under the tuition of his father. Such were his talents and progrcis in literature, that, at the age of 20 years, he published a miscellaneous collection of Latin poems, entitled “Ludus Helecionis sive Carinna Mitel- Lines.” At this time he set out on his journey to England, France, Holland, and Germany. Two years after his return, in 1716, Charles XII., by whom he was highly esteemed, appointed him a fellow to the college of mines; and having directed his attention to physical and mathematical subjects, he published a work, entitled “Dedalus Hyperboreus,” containing an account of experiments made by himself and others in mechanics and natural philosophy; and also a proposal for determining, in a new manner, the longitude of places by the moon. He also printed a treatise on algebra; and he is said to have been the first person who, in the year 1716, published the method of integral and differential calculus. At the siege of Frederickshald in 1718, his scientific acquirements qualified him for rendering service to the besiegers; but having lost his patron on this occasion, he was taken under the protection of Ulrica Eleonora, the sister and succressor of Charles; and in 1719 was ennobled by her. Although he was thus distinguished by royal favour, his zeal in the promotion of science was not at all abated. From some experiments, of which he published an account, he concluded, agreeably to a well-established fact, that the earth is flatter at the poles than at the equator. Affiduous in his attention to the duties of his office, as asfessor to the mines, he visited foreign countries, in order to acquaint himself with their mines; and on his return in 1722, he devoted his time partly to his official services, and partly to his private studies, in which he died in 1753. He had completed his great work, which was published in the following year, under the title of “Opera Philosophica et Mineralia,” in 3 vols. fol. His name has now been most deservedly enrolled among those of the members of the academies of Upsal, Stockholm, and Peterburg; and several distinctions have also been bestowed upon him, as a mark of distinction of his country, by foreign academies and the government. About this time, however, his views were directed to subjects which he conceived to be of much higher importance than those of literature and science. “Whatever of worldly honour and advantage,” says he, “may be in these things, I hold them as matters of low estimation, compared with the honour of that holy office to which I have been called by the Lord himself, who was graciously pleased to manifest himself to
me, his unworthy servant, in a personal appearance, in the year 1743; to open to me a sight of the spiritual world, and to enable me to converse with spirits and angels; and this privilege has continued with me to this day. From that time I began to print and publish various unknown arcana, which have been either seen by me or revealed to me, concerning heaven and hell, the fate of men after death, the true worship of God, the spiritual sense of the scriptures, and many other important truths tending to falsify the false Jesusism and the doctrine in the Lord Jesus; and he published we may enumerate the following, &c.: "De Cultu et Amore Dei," Lund. 1745, 4to. "De Telluribus in Mundo nostro Solari," 1758; "De Equo albo in Apocalypsi," 1758; "De Nova Hierofolyma"; "De Carlo et Inferno"; "Sapientia Angelica de Divina Provenientia," Amsterdam, 1764; "Vera Christianna Religio," Amst. 1730. Concerning the spiritual world he supposed that he had discovered, that it existed not in space. To this purpose he alleges, in his "Universal Theology," that he could there find Americans and Indians every near him, and that he was visited by horses of different nations, and could converse with the inhabitants of other planets, not only in our system, but in other worlds. In this way, as he says, "I have conversed with apostles, departed popes, emperors, and kings, with the late reformers of the church, Luther, Calvin, and Melanchthon, and with others from different countries." After death a man in his opinion, is so little changed, that he does not know but he is still living in the present world; he eats and drinks, and enjoys conjugal delight as in this world; and so great is the resemblance between the two worlds, that in the spiritual world there are palaces and houses, and also books and writings, employments and merchandise, gold, silver, and precious stones. But all these objects are in an infinitely more perfect state than they are in this world. His zeal in propagating these whimsical, not to call them sensual, doctrines was so ardent, that he travelled into distant countries, and circulated his works at an immense expense. At home, it is said, that he was free and social in his disposition; but in foreign countries he was a recluse, and almost inaccessible. He declined worldly wealth and employment; and he lived in the world with the labour of the instruction and benefit of mankind. He had no trait of preciosity or melancholy in his conduct or temper, nor of enthusiasm in his conversations or writings. Thus he is described by his partial friends; and others, less attached to him, represent him as an inoffensive visionary, subdued by the delusions of a disordered imagination. He died in London, in the month of March, 1772; and his remains, after lying in state, were deposited in a vault at the Swedish church, in Well close square. Gen. Biog. SWEDENBORGIANS, the followers of Swedenborg, who form a considerable sect; and whole number of its adherents has increased after the death of its founder, and full subordinates in England, Germany, Sweden, &c. and also in America, under the name of "The New Jerusalem Church;" so called in allusion to the New Jerusalem mentioned in the book of the Revelation of St. John. The following summary will comprehend the discriminating genet of this sect. Whilst the Swedenborgians maintain the unity of God, they conceive that this one God is no other than Jesus Christ, and that he always existed in a human form; and that, in order to redeem the world, he assumed a proper human or material body, but not a human soul; and that this redemption consists in bringing the helle or evil spirits into subjection, and the heavens into order, so as to prepare the way for the introduction and establishment of a new spiritual church; and that, without such redemption, no man could be saved, nor could the angels preserve their state of integrity: that this redemption was accomplished by means of conflicts with evil spirits; and that the last of them, by which Christ glorified his humanity, performed the union of his divine with his human nature, was the passion of the cross. Although the Swedenborgians maintain that there is but one God, and one divine person, they ascribe to this person a real trinity, containing the divinity, the humanity, and the operation of the trinity not being eternally, but commencing at the incarnation. This trinity, composed of Father, Son, and Holy Spirit, resembles the human trinity in every individual man, of soul, body, and operation; and they hold, that as the latter trinity constitutes one man, so the former trinity constitutes one Jehovah God, who is the creator, redeemer, and regenerator. This doctrine, and some other tenets of the Swedenborgians, have been the occasion of a controversy between Dr. Priebsch and some members of the New Jerusalem church, particularly Mr. R. Hindmarsh, a printer. Swedenborg's doctrine is to be interpreted in three distinct senses, denominated celestial, spiritual, and natural; which senses are united by "correspondences," and that it is divine truth, accommodated respectively to the angels of the three heavens, and also to men upon earth. This science of correspondences, left since the time of Job, and revived by Swedenborg, is used by him as a key to the spiritual or internal sense of scripture; every page of which, as he says, is written by correspondences, that is, by such things in the natural world as correspond to it, in the spiritual world. He says, that men are attended by angels, who rejoice in their affections; that temptation consists in a struggle between good and bad angels within men; and that, by these means, God afflicts men in these temptations, since of themselves they could do nothing. He maintains, indeed, that there is an universal influx from God into the souls of men, inscribing them more especially with the belief of the divine unity; and this influx from God, of divine light on the spiritual world, is compared by him to the influx of light from the natural world. Swedenborg denies the doctrine of vicarious sacrifice, predetermination, unconditional election, justification by faith alone, the resurrection of the material body, &c.; and on the other hand, he maintains, that man is possessed of free-will in spiritual things that salvation is not attainable without repentance, and a life of charity and faith, according to the commandments; that man, immediately on his decease, rises again in a spiritual body, which was inclosed in his material body, and which he denominates substantial; and that in this spiritual body he lives as a man eternally, either in heaven or hell, according to the conduct of his past life. Baron Swedenborg and his followers farther maintain, that the passages of scripture, which have been generally supposed to signify the destruction of the world by fire, &c. commonly called the last judgment, should be interpreted agreeably to the above-mentioned science of correspondences, which teaches, that by the end of the world, or consummation of the age, is meant, not the destruction of the world, but the destruction or termination of the present Christian church, both among Roman Catholics and Protetants of every description; and that the last judgment actually took place in the spiritual world, in the year 1775; from which era they date the second advent of the Lord, and the commencement of a new Christian church, which, they say, denotes the new heaven and new earth in the Revelation, and the new Jerusalem descending thence.
SWE

SWEDEN. In their worship, the Swedenborgians use a liturgy, resembling that of the established church of England, as nearly as the difference of doctrines will allow. They introduce into their public services much vocal music, accompanied by the organ; and the dress of their ministers is similar to that of the established church. They have several places of worship in London, Birmingham, Hull, Manchester, and other places in the country. Gen. Biog. Motheim's Eccl. Hist. by Coote, vol. vi. Priezley's Letters to the New Jerusalem Church.

SWEDES, in Agriculture, a term often applied by farmers to signify the Swedish turnip. See Ruta Baga.

SWEDESBOROUGH, in Geography, a small port-town of America, in the state of New Jersey, and county of Gloucester, on Raccoon creek, three miles from its mouth, in Delaware river; 17 miles N. by E. from Salem, and 20 southly of Philadelphia.

SWEDISH TURNIP, in Agriculture, the name of a hard turnip, of which there are two kinds, the yellow and the white, the first of which is by far the best for all purposes in farming. See Ruta Baga.

SWEDISH TURNIP CUTTER, a very neat and simple contrivance, invented for expeditiously cutting or flacing this hard turnip. It is prepared and to be had of most implement-makers.

SWEDLER, in Geography, a town of Hungary; 7 miles S. of Kapffdorf.

SWEDONG, a town of the Birman empire, on the left bank of the Ava; 10 miles N.E. of Pagonmew.

Sweep, among Refiners, the almond-furnace. See Almond and Furnace.

Sweep, among Goldsmiths, Moneyers, &c. See Washing.

Sweep, in the Sea Language. The seamen call the mold of a ship, when the begins to compass in at the rung-heads, the sweep of her, or the sweep of the futlock.

Sweep of the Tillar, in Ship-Building, a semicircular plank of oak, three inches thick and eleven broad, fixed up under the beams near the fore-end of the tillar, which it supports. On the fore-side of the sweep is a groove for the tillar-robe, in which groove-rollers are fitted to enline the rope. On the aft-side is a ledge or rabbit, defended with an iron plate, on which the gooseneck of the tillar traverses.

Sweer-Bar of a Waggon, is that which is fixed on the hind part of the fore-guide, and paifes under the hindpole, which slides upon it.

Sweer, Hay, in Agriculture, that fort of tool or contrivance which is employed for readily getting hay together. It is of great importance to every hay-farmer, who is in the practice of making his stacks of this fort in the field, to be in possession of a machine of this kind, as it not only saves the labour and trouble of loading carts, but is capable of being managed without any difficulty by few persons, and as much hay being often capable of being got together, and to the stack by it in a few hours, as two or three, as is usually done in half the day, in the ordinary cart-code.

Sweeping, at Sea, signifies dragging along the ground, the bight, or loose part of a small rope, in a harbour or road, in order to hook or recover some anchor, wrack, or other materials sunk at the bottom. It is performed by fastening the two ends of this rope to the sides of two boats which are abreast of each other, at some distance. To the middle of the rope are suspended two cannon shot, or something which weighs heavy, in order to sink it to the ground; so that, as the boats advance, by rowing a-head, the rope draws along the bottom, to hook any anchor, &c. for which they are searching.

SWEEPING APPARATUS, in Practical Astronomy, an apparatus contrived and used by Dr. Hertieh, for turning his telescopes to any part of the heavens, for the purpose of making observations, which he calls sweeping the heavens; for an account of which, see Telescope.

SWEEPING OF CHIMNEYS, in Domestic Economy. See Chimney.

SWEEPINGS OF STREETS AND HOUSES, in Agriculture, used as manure, are to be regarded as a composed material, and to be moily capable of being applied to the land, without undergoing any kind of preparatory process for that purpose. This is a manure that may be employed in different ways, and which is often capable of being done, by hand, over the ground, or a town was a top-dressing.

Sweeps, in Ship-Building, the various parts of the bodies shaped by segments of circles; such are the lower sweeps, lower-breadth-sweep, upper-breadth-sweep, and back-sweep, or top-timber-hollow.

Sweeps are large oars, used sometimes by ships, &c. See Sweepstakes.

Sweepstakes, in Geography, a town in the tract of Magellans. S. lat. 52° 42'. W. long. 71° 24'.

SWEET. By a sweet is understood any vegetable, whether obtained by means of a fungus, raifin, or other foreign or domestic fruit, which is added to wines, with a drop to improve them. It is plain, from the making of such must, or flum, by means of fine sugar, with a small addition of tartar, that the art of sweet-making might receive a high degree of improvement, by the using pure sugar, as one general wholesome sweet, instead of those infinite mixtures of honey, raifins, raisins, treacle, flum, cyder, &c. with which the sweet-makers supply the wine-coopers to lighten on, or amend their wines: for pure sugar being added to our poor wine, will ferment with it, and bring it to a proper degree of round or arrow, as the sweet is to be amended by tartar. So tartar should be added to the sugar; but if it be too sweet or luscious, that the addition of tartar is necessary. Shaw's Lectures, p. 106.

See Artificial Stomach.

By 43 Geo. III. c. 69, every maker of sweet woods, other than mead, for sale, shall take out a licence at 2s., and renew it annually, on pain of 30l.; and by 10 & 11 W. c. 21, every person who shall sell or use any materials used in the making of wines, and in whose custody or quantity exceeding two gallons of any kind is found, shall be deemed a maker of sweet woods for sale. By 43 Geo. III. c. 69, a duty on sweets or made wines is imposed, and by 43 Geo. III. c. 81, a farther duty. By the same act, every retailer of sweet woods or British-made wines shall take out a licence at 2l. 4s., which shall be renewed annually; and retaining without licence incurs a forfeiture of 50l. Persons dealing in sweet woods or sweet wines in their own houses or places adjoining are required to take out a licence for selling ale and beer from the same house, 28 Geo. III. c. 37. 32 Geo. III. c. 59; subject to the same penalties as selling without licence, referred to 3 Geo. III. c. 45. The house or place where British-made wines or sweets are sold shall be entered. Any person shall be deemed a retailer, who sells twenty-five gallons, or a less quantity. By 26 Geo. III. c. 74, retailers are required to put up in some conspicuous place in the front of his house, the words 'Dealer in British wine.' Persons making sweets or wines shall give notice of their names and places of abode, and of the rooms and places used for making or keeping them, to the excise-officers, on pain of 20l. (10 Geo. II. c. 17.) Concealing sweets from the eye of the gauger, incurs a forfeiture of 40l. for every barrel (7 & 8 W. c. 50.) Removing sweets, that have paid the duty,
duty, without a permit, incurs a forfeiture of 10s. a gallon, and also the liquor and caffs. (6 Geo. c. 21.) See Wines, Domestic.

Sweet Almonds. See Almonds.

Sweet Apple. See Annona.

Sweet Briar, the English name of a shrubby plant of the briar kind, not unfrequently cultivated in gardens and pleasure-grounds, for the sake of its fragrant and delightful smell. (See Rosa.) The sweet briar is also employed for the purpose of forming hedges in particular situations. See Quickset Hedge.

Sweet Corn, a term used by the Indians to express a fort of corn they are very fond of, and generally keep in their houses.

While the ear of the maize, or Indian corn, is yet green, but full, they gather it, and ffirk boil, and afterwards dry it, and lay it up for use in bags or baskets. When they eat it, they boil it again, either whole or grobly beaten in a mortar; they then mix it with fish, or with venison, or beaver flesh, and account it a very fine dish. The green ears, or fresh sweet corn, they also sometimes eat, as soon as it is gathered, roasting it before the fire, and then picking out the grains. This is a new supply of food for them many times, when their winter, or last harvest-store is exhausted. Their soldiers also commonly go out to war against their enemies about this time of the year, and find this supply in their enemies' fields. See Maize.

Sweet Flag. See Acorus.

Sweet Meadow-Grafs, a name sometimes applied to a gräf of the meadow kind by writers on husbandry. See Holcus.

Sweet-Scented Soft Grafs, a fort of grafs which is met with in moist meadows and, which, from the results of the trials lately made under the direction of the duke of Bedford, appears to contain considerable nutritive properties. They are given in Sir Humphrey Davy's work on Agricultural Chemistry.

The proportional value which the grafs, at the time of flowering, bears to that, at the time the feed is ripe, is as 17 to 21.

The grafs of the latter-math crop, and of the crop at the time of flowering, taking the whole quantity, and their relative proportions of nutritive matter, are in value nearly as 6 to 10. The value of the grafs at the time the feed is ripe, exceeds that of the latter-math, in the proportion of 21 to 17.

It is noticed, that though this is one of the earliest of the flowering grafs, it is tender, and the produce in the spring is inconsiderable. If, however, the quantity of nutritive matter which it affords be compared with that of any of those species which flower nearly at the same time, it will be found greatly superior. It sends forth a small number of flower-flakks, which are of a slender structure compared to the size of the leaves. This will account, in a great measure, for the equal quantities of nutritive matter afforded by the grafs at the time of flowering, and the latter-math. See Holcus Odoratus.

Sweet-Scented Vernal Grafs, an early field-grafs, which is cultivated to advantage on some forts of soil. It has been recommended in a paper in the third volume of the "Transac- tions of the Highland Society of Scotland," that this grafs flowers early, grows in every variety of soil, is closely eaten down by cattle in pastures, but feeds chiefly advan-
tageous in meadows for hay, which it sweetens to a high degree. No plant, it is thought, answers better in manured soils conferring of peat-earth. In soft soils, it arrives at a very considerable size, and is certainly grateful to all do-

meatly grazing animals. The feeds are all bearded, have a peculiar appearance, and are easily collected. It is perennial, and makes no great appearance in newly-own'd meadows, but enters generally into the hay of most of our natural meadows, and is eaten sweetly in the sap. For although it does not much abound in leaves, that is not, it is sup-
posed, a good reason for calling the plant into disrepute. The flaky, when taken in the juice, either for pasture or for hay, is undoubtedly grateful to sheep and cattle, being then in the succulent state.

In the Cheshire Corrected Report on Agriculture, it is thought, that though cattle are extremely fond of this grafs, and it makes excellent hay, it may be doubtful whether it is profitable as a meadow-grafs. It is by no means produc-
tive, and as it flowers and ripens its seeds much earlier than any of the other grafs, it is ill adapted to mix with them. It is common in that district on sandy loams.

Its properties and qualities have, however, been set in a full and clear point of view, by the results of experimental trials which have lately been made, under the care of the duke of Bedford, at Woburn Abbey, by Mr. Sinclair, his grace's gardener, but our limits will not allow a detail.

It appears upon the whole, that the proportional value which the grafs, at the time of flowering, bears to that at the time the feed is ripe, is as 4 to 13. And that the proportional value which the grafs of the latter-math bears to that at the time the feed is ripe, nearly as 9 to 18.

It is thought, that the smallness of the produce of this grafs renders it improper for the purpose of hay; but that its early growth, and the superior quantity of nutritive matter which the latter-math affords, compared with the quantity afforded by the grafs at the time of flowering, causes it to rank high as a pasture-grafs, on such foils as are well fitted for its growth; such as peat-bogs, and lands that are deep and moist. See Stock, Live, Choice of Food in. See also Grass, and Grass-Land.

Sweet Gum. See Liquidambarr.

Sweet John. See Dianthus.

Sweet Maudlin. See Achillera.

Sweet Pea, the English name of an ornamental pea, not unfrequently cultivated in the garden and other places for that purpose. See Lathyrus.

Sweet Root. See Liquorice.

Sweet Ryf. See Acorus.

Sweet Sorb. See Annona.

Sweet Sultan. See Centaurea.

Sweet Weed. See Capraria and Scoparia

Sweet William, the English name of several species of pink. See Dianthus.

Sweet William of Barbados. See Scarlet Convol-
uulus.

Sweet Willow. See Myrica.

Sweet Milk Cheese, in Rural Economy, a term used to signify that which is made from the whole milk, without abstractive the cream. It is seldom made for sale in this way, but sometimes, for private family use, it is prepared from the whole of the milk. (See Cheeses.) The theory of preferring all the richness possible to cheese of this kind, seems, it is laid by the writer of the Account of the Agricul-
ture of the County of Pekock, to depend upon the follow-
lowing principles and circumstances, which experience seems to have fully and abundantly ascertained: 1. That the cream is evaporable in a degree of heat not very intense; as is evident from the equal poorness, both of the cheese and of the whey, when the milk is too much heated before putting the rennet or yearning to it. 2. That the adhesion of the cream to the curd part of the milk is but slight as is evi-
S W E

Swell, in Sea Language, generally denotes a heavy and continual agitation of the waves, according to a particular direction; as there is a great swell setting into the bay. It is, however, more particularly applied to the fluctuating motion of the seas, which remains after the expiration of storms, and also to that which breaks on the shores of rocks and shallows, called surf; which see. Falconer.

Swell, in Surgery. See Tumour.

Swellimg or Leg-Eat, or Ill, a disease among sheep, which afflicts them in the legs as well as some other parts. It is said in a paper in the third volume of the "Transactions of the Highland Society," that in the most part, begins at the knees, which swell and enlarge to a considerable degree, causing so much lameness, as to prevent the sheep so affected from following the rest of the flock. But sometimes it begins at the head part of the leg, or even in the hinder part. In some instances, it is indeed frequently, having small blisters scattered over the leg affected, of a red colour, and filled with a black-coloured watery fluid. When the skin bursts, it leaves below it a loose flabby subsidence of the same colour, or rather darker, which extends even to the bone. It commonly first begins in one of the hind-legs, but as it advances to the four, unless death takes place before this happens. It occasionally spreads from the hind-legs to the belly, and in every case the kidneys are affected, being loose and flabby, having some resemblance to the swelling of the legs, and being sometimes of a livid colour. In some cases the disease proves very quickly fatal, while at other times it will continue in a mild state for weeks. It spreads very rapidly after appearing in a flock, and if not speedily attended to, will injure them materially. It is, in general, very dangerous, cutting off the greater proportion of those which are affected with it. Indeed, many shepherds kill the diseased sheep whenever they are seen to be affected with it, in order to prevent its spreading. In this disease, too, the eyes of the sheep is languid, its tongue dry, it cannot eat, and in general is soon cut off by the complaint.

It commonly appears about the latter end of summer, but at times in the beginning of the autumn; arising at first, it is supposed, from such sheep as have unhealthy conditions, being too much exposed to wetness during rainy weather. Scratches in the legs, it is said, will produce it in such sheep as have bad constitutions. If the sheep get their legs dirtied in the time of clipping, or smearing, a houle where there is much dung, they will be liable to be readily affected with the disease. Boggy ground has also a tendency to produce it, from the similarity of circumstance.

The sheep most subjects to this disease are, the sheep on the diseased estate, the Scotch and English breeds; but that, when it has appeared in a flock, the black-faced, heath, or Scottish sheep, are equally liable and subject to it. It has almost never appeared to the north of the Tweed, although it has of late been pretty common on its southern banks, in the shires of Selkirk, Roxburgh, and part of that of Peebles. It is conjectured that the

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gent from the richnefs of the laft drainings of the whey, which, in sweet or whole milk cheefe, are very rich cream, if the curd be too hard wrought by the hand, or if it be too hard prefled at firft, immediately upon its being committed to the cheefe-pres. 3. That the whey, if not soon separated, speedily contracts the acid state, and then the perfect fermentation in the cheefe; making the cheefe fwell, tainting its smell and taste, and rendering it unfit for keeping.

Hence the propriety and utility, it is thought, are fhewn and indicated, firft, of putting the rennet or yeaming to the milk as cool as may be; secondly, of the moderate working of the curd by the hand in extrac ting the whey; together with a due and well-regulated preffure, moderate at firft, and gradually increafing, when it is put into the cheefe-well or vat, and submitted to the action of the cheefe-pres; or the praftice which is in ufe in fome places, of taking the curd repeatedly from under the cheefe-pres, and fifting it into small pieces, which areexpo led, at each fuch operation, upon a fieve, for the purpose of draining and drying by the air; that, thus, the aq ueous particles of the whey drippings off or exhaling, the cream becoming dry, may continue adhering to the curd, while undergoing the laft more strong confolidating preffure.

The length of time of the preffure is moftly about twenty-four hours, as fuiting the usual praftice in this forte of businesses, without increafing the expence of apparatus.

The cheefe, in these cafes, is sometimes failed in the curd; at others, only by rubbing fat in upon the skin or outside of the cheefe after it is made; and occasionally, by putting it in fat pickle, but which is thought to extract fome of its richnefs.

The praftice on which the praftice is founded of making the richest cheefe of this forte, is, it is faid, etablis hed in experience; and is, that a fmall quantity of the whey taken off, made boiling hot, and poured upon the remainder, caufes the curd infinitely to confolidate and expel the whey, the cream part meantime remaining united with the curd; the mass of curd is then fifted from the whey, and plunged into the coldest spring-water, which congeals the cream, from its state of liquefaction by the heat; and it is then put into the cheefe-well or vat and submitted to the preffure.

This praftice of making fuch rich cheefe is highly deferving of the notice and attention of thofe gentlemen and families who have it made for their own particular ufe.

SWEET Sublime of Mercury. See Mercury.

SWEET Herb Lake, in Geography, a lake of North America. N. lat. 54° 40'. W. long. 99°.

SWEET Edinburgh's Keys, a cluster of islets and rocks in the Spanish Main. N. lat. 14° 55'. E. long. 82° 55'.

SWEET Spring, a poft-town of America, in Virginia; 38 miles S.W. of Philadelphia. The mineral springs of this place draw four or five hundred people together for health and amufement, during the months of July, August, and September.

SWEET Water Creek, a river of Kentucky, which rises among the eastern branches of Bear creek and Tombigby; runs N., and discharges itself into the Tennessee three miles above Long Island. It derives its name from the springs of excellent water with which it is supplied.

SWEG, a town of Sweden, in Jerekalen; 32 miles S.E. of Langhaldan.

SWEIN, a town of Africa, in the kingdom of Dar Fur; which is a place of general retort for merchants trading to Egypt; 45 miles N. of Cobe.

SWELL of an Organ. See Organ.
may, in part, be owing to the long or white-faced sheep being there principally kept as the flock.

It is suggested in regard to the cure, that, as this is a very dangerous disease, the sheep affected with it should be brought home as soon as possible, to prevent it from infecting the flock, and its legs be well washed with soap in water; afterwards bathed with lime-water, or a solution of alum in water, and then anointed with what in the shops is known by the name of *citrine* ointment, which is made with mercury dissolved in aqua fortis, and mixed with hog’s-lard. If this be not at hand when the legs break out and run, a little quick-lime may be dusted on the foughs, and the leg dressed with a clot, spread with fresh butter, and a little tar. These dreslings should be changed every second day: care should also be taken that the sheep have good and dry pastures during the time of the cure; and water, in which moss or peat-earth has been soaked or steeped, may sometimes be preferred, in cases where it can be had, on account of its astringent or antiseptic quality, to common water, for their drink, as well as for washing the legs with.

After clipping or smearing in grounds subject to this disease, driving the flock through a pool or river, so as to wash their legs well, is, it is thought, a very proper practice; and that clipping the hair short upon them prevents any dirt from lodging on them. This disease has sometimes the name of *black-leg* given to it. There is a disease somewhat similar to this affecting the tails of sheep.

By properly applying means of this nature, this disease may mostly be, in some measure, either guarded against, or got the better of, without any very great trouble or difficulty.

**Swelling or Rolling Away**, a disease of the itching inflammatory kind on the backs of sheep. It is said that these animals are the most liable to die away, or of this disorder, in those farms which it suddenly grows or becomes worse, after showery weather, in the early spring, as from towards the beginning of the month of May until they are thorough.

The appearances of it are, that they lie down, roll on their backs, to relieve the irritation and itching there; when, if the ground happens to be level or hollow, or if they should be week, heavy with lamb, fat, or full-fed, they are not uncommonly unable to get up, and of course soon sinken, swell, and die. It is noticed also, that the fleece of the sheep which die away, or of this swelling disease, resembles much in the taffe, colour, and fimeal, that of sheep which are carried off by the fribing-ill, blood, or sickness.

In this situation of the disease, where the sheep are found down, they should be lifted up gently, care being taken constantly, towards the evening of every day, to see that none of them are thus down upon their backs. It is not improbable that small doses of calomel might be used daily, for two or three days, with much advantage, as about half a drachm for each dose; and that, at the same time, a weak cooling solution of white vitriol might be poured on the itching part of the back, so as to abate the itching there, and thereby relieve the animal from much diffus and uneafines.

**Swelling in Chees** in, *Rural Economy*, the heaving or enlarging of it in the dairy or other place. The cause of this injury and mischief to it, has been very differently considered by different dairy farmers, and for which various causes have been assigned.

Allowing for the operation of some other causes, it may be suspected that the rankfees of the herbage is the most common and prevailing one. Under some sorts of dairy management, particular farms in some districts have been noticed for producing heaved or swelled cheeves, whereas, by other kinds of management, this has scarcely ever been the case. This is often supposed to depend on some substance being secretly employed as an antidote, which has either the power of lowering the milk, or of counteracting its disposition or tendency to ferment and beast. Such a secret substance is pretended to be poffessed by many in some cheese-dairy counties, though it is not attended with success in preventing this effect in all cases.

A farmer of this farm has, however, been stated to have come to a farm on which the cheeves had always been spoiled by heaving or swelling, and which, as the land was extremely good, was supposed to depend upon that as the cause of the injury; yet little mischief of this nature is said to have been experienced by him since he came upon it, and which is ascribed to the practice of constantly using in mixture with the rennet, previously to its being put to the milk, about a table-spoonful of a solution of blue vitriol, in proportion to that which is necessary for the milk of about twenty cows. In other cases, the same practice has, however, failed of success.

In Chefs they consider this mischief as constantly arising from the too great generation of air in the cheeves, as the swetting in it is unquestionably a fermentation; and that where this proceeds has been regular and complete, the over-proportion of air is expelled, and the cheese subject afterwards to heave or swell. But that when this fermentation or swetting has been incomplete, as may happen from all the causes that check it in other cases, the cheese will be liable to swell or hove at any time, by any sudden change in the state of the atmosphere, as the approach of thunder, the variations of the weather from fair and dry to rain, and others of a similar kind; such changes producing alterations in the state of the air in the cheefe, those are made to swell or hove the moft, which abound moft with impure air; which are mostly thofe made from rich, narrow, artificial, granful patures.

It is, of course, thought advisable to produce this sweating in the cheefe as soon as possible after the making of it has been finished, as that is the most likely means of preventing this mischief. Little or nothing has, however, yet been done to properly regulate the heat or temperature of cheeves-rooms in this or other views. See Sweating-Rooms for Cheefe.

There can be no doubt that the more completely the whey is got out of, and removed from the curd, the less air will be left, and the less danger there will be of its being generated. This should, therefore, always be done as completely as possible.

It has been suggested too, that cheeves may perhaps be les subject to heave or swell, if made wholly of cold or of warm milk, that is, of one equal temperature; as the blending of warm and cold liquids together may disperse the generation of air in the cheeves. The most usual method of counteracting and restraining this evil in the above districts, is that of forcing it down by the use of light weights. Blistering in cheeves is also an effect which proceeds from the same cause, but which only affects the superficial parts.

The common means of removing blisters of this nature is by the use of a sharp instrument to open them, and by pouring hot water or whey into the openings, then pressing the ind well down, covering it with salt, and placing some flaty substance, with a small weight on it the parts.
Careful management is, of course, all that can be really depended on in this business.

SWELLY, in Geography. See Swilly.

SWERGA, in Hindu Romance, is the heaven of Indra, the regent of the firmament. (See Indra.) The Hindu gods have a paradise celestial and terrestrial. Sitanta is the name of the earthly abode of the Hindu Jove, placed on the wonderful Meru. (See Meru and Sitanta.) The Hindu heaven has many mansions. Swurga seems to be the fifth, whence demigods may be banished for misdemeanors, and condemned to be again on earth.

SWEERT, FRANCIS, in Biography, was born at Antwerp in 1567, and being a man of letters, employed himself in the composition of a number of learned works. Of these, the principal are "Rerum Belgicarum Annales Chronicos et Historicos Antiquos et recentiores" 2 tom. fol.; "Athene Belgice," fol.; "Deorum et Deorum capita ex antiquis Numismatis," 4to. in LinnEus's Greek Antiquities; "Monumenta Sepulchralia Ducatus Brabantiae." He died in 1629. Moretti.


Geo. Ch. Cal. Perianth inferior, in five deep, lanceolate, flat, permanent segments. Cor. of one petal, wheel-shaped; limb flat, in five deep lanceolate segments, larger than the calyx, connected to the base of the flower. Nectaries ten, composed of two small depressions, at the bottom of each segment of the corolla, on the inner side, each surrounded with minute upright bristles. Stem. Filaments five, awl-shaped, moderately spreading, shorter than the corolla; anthers oblong, incumbent. Pist. Germin superior, ovate-oblong; style very short, deeply divided; stigma two, simple. Peric. Capsule ovate, slightly compressed, acute at each end, of one cell and two valves. Seeds numerous, small, nearly orbicular, with a membranous border, "all inferted into the margins of each valve." Gartn.

Eff. Ch. Corolla wheel-shaped, with two stamens and orbicular stigmas, at the base of each segment. Capsule superior, of one cell and two valves. Seeds numerous, bordered, inferted into the margins of the valves.

Obf. Some species, as Linnaeus remarks, have four-cleft flowers; others have the nectaries projecting behind, in the form of little horns.


Germs often abortive. The leaves are staked, ovate, or ovate-lanceolate, mostly radical, entire, of a fine shining green. It is to be regretted, that this handsome plant can scarcely be cultivated in a garden; or rather, growing always in inundated ground, can hardly be transported from its native alps. Its qualities agree with Gentiana; see that article.

2. S. difformis. Various-flowered Swertia. Linn. Sp. Pl. ed. 1. 126. ed. 2. 318. Willd. n. 2. (Swertia; Gron. Virg. ed. 2. 30. Chironia paniculata; Michau Boreali-Amer. v. 1. 145. Sabattia paniculata; Pursh 138.) Stem erect, quadrangular. Leaves linear-lanceolate. Panicle oppositely branched, somewhat level-topped, with very long stalks. Flowers with five segments; the terminal one with six?—Found in the bogs and cedar swamps of New Jersey and Carolina, flowering in July and August. Flowers white. "Clayton, Pursh." Not having seen a dried specimen of this plant, we retain it here merely a conformity to Linnaeus, who, after having described the species from a specimen of Clayton's, subseqently lost its appearance, and placed in his herbarium, under the short name, a herbarium of the following, which we have Mr. Pursh's authority for being totally different. As to our idea of his genus SABATTIA, we refer the reader to that article, not having, as yet, had the means of coming to any conclusion on the subject.

3. S. Fraera. Fraerian Swertia. (S. difformis; Herb. Linn. but not Sp. Pl. Fraera carolinensis; Wal. Carol. 88. F. Walteri; Michaux Boreali-Amer. v. 1. 97. Pursh 101.) —Stem erect, opposite or whorled. Flowers in aggregate clusters, four-cleft.—Found in the swamps of Lower Carolina, and on the borders of lakes in Pennsylvania and New York, flowering in July. "Nerious branchial. Stem from three to five feet high. Flowers greenish-yellow, sometimes mixed with purple. The whole plant has a very flat appearance. Pursh. We received from the late Mr. Fraer, in 1788, a very incomplete specimen of this, much like what Linnaeus poissled, and mistook for his own Swertia difformis, and which led us into an error respecting that plant. See the foregoing species, and our article Fraerra.

4. S. rovata. Wheel-shaped Swertia. Linn. Sp. Pl. 326. Pall. Roff. v. 1. part 2. 98. t. 89. (S. n.; Gmel. Sib. v. 4. 112. t. 53. f. 1.) Gentiana rovida; Willd. Sp. Pl. v. 1. 157.)—Stem erect, panicled, leafed. Leaves lanceolate, sessile. Flowers five-cleft, flat.—Native of swamps in Siberia, flowering in August and September. The root is small and annual. Stem about a foot high. Flowers very various in breadth. Flowers copious, show an inch wide, of a fine blue. It appears to us as evidently that this is a genuine Swertia, as that Gunner's S. rovata, figured in Fl. Dan. t. 343, is a real Gentiana. See below, as above.

SWE

—Native of the loftiest mountains of Carinthia. Annual. Stem very short, leafy; in stunted plants quite simple and single-flowered. The flowers are bright blue, nearly as large as the leaf, each on a simple stalk, about two inches in length, which is almost the height of the whole plant.


7. S. corniculata. Spreading-horned Swertia. Linn. Sp. Pl. 328. Willd. n. 4. Pall. Roff. v. 1. part 2. p. 99. t. 90. f. 1. (S. n. 80; Gmel. Sib. v. 4. t. 53. f. 3.)—Flowers four-cleft, bell-shaped, with four ascending spurs. Leaves lanceolate, sessile. Branches elongated.—Native of birch thickets, and open groves, in Siberia. Gmelin. The root is annual. Stem erect, round, slightly angular, leafy, about a foot high, either simple, or branched from the bottom. Leaves ovate-lanceolate, three-ribbed, an inch and a half long. Flowers axillary and terminal, numerous, on longish stalks, yellowish-green, not much expanded, each segment of the corolla furnished, at the base behind, with a spreading ascending spur to the nectary, nearly as long as the corolla itself.

8. S. deflexa. Drooping-horned Swertia. (S. corniculata; Pursh n. 1.)—"Flowers four-cleft, bell-shaped, with four deflexed spurs. Leaves ovate. Branches short."—In swamps of Canada, and round the lakes of the western part of the United States, flowering in July. —Root biennial. Flowers greenish-yellow. Pursh. This author has hinted the propriety of distinguishing the American S. corniculata of Linnæus, first found by Kalm, from the Siberian, and we adopt the characters he has pointed out, not having ourselves seen the former species.

9. S. recurva. Curve-horned Swertia. — Flowers four-cleft, bell-shaped, with four recurved spurs. Leaves linear-lanceolate; the lower ones tapering down into long-winged footstalks. — Gathered in Mexico by Escallon, and sent to Linnæus by Mutis. The stem, in our only specimen, is a foot high, slightly angular, leafy, smooth, quite simple, except a few short leafy branches at the bottom. Lower leaves lanceolate, three-ribbed, above an inch long, on winged stalks of nearly equal length; upper almost leafless, shorter, and nearly linear. Flowers few, apparently yellowish or whitish, in a short, simple, terminal cluster. Spurs shorter than the corolla, more or less hooked, or curved upwards.

10. S. dichotoma. Forked Swertia. Linn. Sp. Pl. 329. Willd. n. 5. Pall. Roff. v. 1. p. 2. 100. t. 91. (S. n. 79; Gmel. Sib. v. 4. t. 113. f. 3.)—Flowers four-cleft, without spurs, drooping. Leaves elliptical. Stem much branched.—In thickets, and gruffy muddy places, in Siberia, flowering in May and June. Annual, from three to six inches high, many leafy, leafy, and profusely covered with small, white, four-cleft flowers. Nectaries as described in the generic character.

11. S. tetrapetala. Cruciferm Swertia. Pall. Roff. v. 1. p. 2. 99. t. 90. f. 2. Willd. n. 6.—Flowers four-cleft, flat, without spurs, erect. Leaves lanceolate. Stem simple.—Gathered by Steller in Kamtschaktska, at the mouth of the river Appallas. Pall. Annual, six inches high. Leaves elliptic-lanceolate, nearly or quite sessile. Flowers about half an inch in diameter, all four-cleft, blue; not, as the name implies, of four distinct petals. We cannot help observing that the numerous errors of the editor of the Flora Siberica, in quoting his own plates of this genus, are implicitly copied by Pall as well as Willdenow; an inference, among many others, of the negligent manner in which synonyms are too often compiled.


13. S. pufilla. Dwarf Swertia. Pursh n. 3.—"Corolla flat, twice the length of the calyx. Stem quite simple and single-flowered. Leaves obovate."—In the more elevated regions of the White hills of New Hampshire, flowering in June; as well as of Labrador. Annual. The whole plant scarcely above an inch high, with one or two pair of small leaves, and a considerable-sized blue flower. Segments of the corolla obovate, pointed; those of the calyx obtuse. Pursh.

SWETADEV, a name of the Hindoo goddess Parwati; which fee.

SWETARA, in Geography, a river of Pennsylvania, which falls into the Susquehanna from the N.E., about 7 miles S.E. of Harritsburg.

SWETOE, a small island in the Capian sea, separated from the W. coast by a narrow channel, called the "Straits of Aperhon," through which vessels often fail. In this island is found black and dark grey naphtha, which is carried from the springs into pits or reservoirs by means of troughs, whence it is conveyed into boats; 25 miles E. of Buchu.

SWIDDEN, in Rural Economy, a provincial word signifying to finge or burn off, as heath, or the coats of swine.

SWIECICA, in Geography, a town of Lithuania; 50 miles N.E. of Pink.

SWIERZNO, a town of Lithuania, in the palatinate of Novogrodok; 36 miles E. of Novogrodok.

SWIETEN, Gerard van, Baron, in Biography, first physician to their imperial majesties at Vienna, was born at Leyden, on the 7th of May, 1700. He was a deceiver of an ancient and reputable family of the Low Countries, but left his parents at an early age, in consequence of which his early education was said to have been somewhat neglected.

Having passed through the usual grammatical studies, he was sent at the age of sixteen to the university of Louvain, where he was soon distinguished by his industry and superior attainments in the philosophical classes. Determining, however, upon following the profession of medicine, he returned to Leyden, where he became a most zealous and favourite pupil of the illustrious Boerhaave. After seven years of study under this great master, he took the degree of doctor in 1725, at which period, the indefatigable industry with which he had profited, not only from the learning and knowledge of his tutor, but from the most unremitting personal research, had already raised him to a high rank among men of science, and he was immediately appointed to a medical professorship, which he occupied for many years with great distinction. To his lectures, as well as to those of his celeb
brated colleague, the medical students of Germany, France, and England, reformed in crowds; a circumstance calculated to excite the enmity of the invidious, who were illiberal enough to cover their opposition under the mask of religion, and to demand the enforcement of the law, which prohibited those not professing the religion of the state from holding any public appointment. Van Swieten was of the Roman Catholic religion, and was consequently obliged to resign his chair, which unless acquired, he devoted to the composition of his excellent Commentaries on the Aphorisms of Boerhaave; the first volume of which had already appeared, and the second was nearly concluded, when the high reputation which he had acquired throughout Europe, obtained for him an invitation from the empress Maria Theresa to settle at the court of Vienna. He accepted this invitation, and removed to Vienna in the summer of 1745, after having stipulated that he should be allowed to follow his usual course of life. He would not even change his mode of dress, but appeared at court with his own lank hair, and without ruffles, till the empress presented him with a pair worked by her own hands.

His indefatigable zeal, his rigid love of order, his knowledge of the ancient and modern languages, his general erudition, and his intimate acquaintance with all the branches of medicine, and the collateral sciences, together with his inflexible love of justice and decorum, rendered Dr. Van Swieten the person in all respects qualified for taking the lead in the medical school of Vienna; and that city and medical science in Germany were ultimately beneficial to his exertions. One of his first attentions was directed to reform the medical studies of that university, for which purpose he undertook the labours of a professorial chair, which he held till 1753; and he displayed great firmness and zeal in eradicating the abuses which had long prevailed in this department, and contributed not only to supply the country with able physicians, but laid the foundation of the flourishing school of medicine, for which that capital has since been celebrated. Having obtained the full confidence of his royal mistress, he was enabled to procure all possible advantages for the prosecution of medical science in that university. He obtained the rebuilding of the college, with the addition of a chemical laboratory, of schools of surgery and anatomy, and of a clinical establishment in one of the first hospitals, and the augmentation of the botanical garden. His extensive erudition obtained for him the full farther honour of being deemed the most proper person to be entrusted with the interests of learning in general in the Austrian dominions, and he was appointed imperial librarian, vice-president of the imperial commission superintending the studies of the Austrian territories, and president of the censorship of books, as well as perpetual director of the faculty of medicine throughout Austria. He had the merit of introducing a liberal improvement in the conduct of the imperial library, that of permitting visitors to make notes and extracts from the books, which a barbarous regulation had before prohibited. In discharging the duties of the censorship, the rigour of his temper and principles induced him to proceed without mercy the writings of the French philosophers, some of whom repaid his hostility by vilifying epithets. The same inflexibility of character also led him to maintain a long opposition to the salutary practice of inoculation. In addition to the many honours and emoluments conferred upon him by the imperial family, who also created him a baron of the empire, he was voluntarily enrolled in the list of their members by almost all the distinguished literary societies of Europe, in testimony of their respect for his reputation and character. He continued, even in advanced age, sided by good health, to fulfil his various duties with unremitting fidelity; but the vigour of his constitution began to fail about the year 1770, and after three years of declining energy, he was attacked with a mortification in one of his toes in June 1772, which terminated fatally, after he had prepared for death by an exemplary performance of all the acts of devotion enjoined by his religion. He died at Schönbrunn, but the remains were not interred in the church of the Augustines at Vienna, and erected a statue to his memory in one of the halls of the university. She had placed his portrait there, with a complimentary inscription, during his life.

The great work, upon which the reputation of baron Van Swieten will be handed down, is his copious and learned commentaries upon the aphorisms of his respected master; it is entitled "Commentaria in Hermanni Boerhavii Aphorismos de Cognoicendis et Curtandis Morbis," and extended to five volumes quarto. It is a vast magazine of medical practice and pathological research, the result of the author's extensive reading and of his personal experience; and though much alteration has taken place both in the theory and practice of medicine, since the commencement of its work, yet the immense mass of well-lecited and well-arranged fact which it contains, and the judicious summary of the knowledge of the best ancient writers as well as of his own time which it presents, will always maintain its value. It has been translated into most of the European languages, and a very good English translation, in eight small octavo volumes, with a copious general index, was printed at Edinburgh in 1775. In addition to this repository of medical erudition, the author published another useful work, entitled "Description abrégée des Maladies qui regent communément dans les Armées, avec la Méthode de les traiter," 8vo. printed at Vienna, 1759. See Ely, Dict. Hist. de la Med. Gen. Biog.


was introduced at Kew early in the last century. - A tree of very handsome appearance, lofty and branching, with a trunk frequently from four to six feet in diameter. Leaves pinnate, reclining, alternate, shining, numerous on the younger branches; leaflets mostly in four pairs, without an odd one, opposite, stalked, entire, pointed. Petals corolla, with about eight flowers in each, small, whitish, occasionally of a reddish or fawn colour. Fruit large, woody, russet-coloured.

The excellence of this, the old Jamaica Mahogany wood, is sufficiently known.

2. S. flabellata. Febrifuge Mahogany-tree. Wild. n. 2. Roxb. Coromandel. v. 1. t. 18. t. 17. - Leaves pinnate, of about four pairs of elliptical, rounded leaflets; unequal at the base. Panicule terminal, divaricated. - Native of mountains in the East Indies. - A very large tree, with a lofty straight trunk, covered with a grey, scabrous bark. Branches numerous, the lower ones spreading, the upper ascending. Leaves alternate, abruptly pinnate, about a foot long; leaflets opposite, stalked, oblong, entire. Panicles large, terminal, diffuse, bearing numerous, small, whitish, white inodorous flowers. Fruit large, greenish. The wood is of a dull red colour, remarkably hard and heavy. The bark is internally reddish, and has a bitter, astringent flavour. The Telingas call this tree Syconia.


Method of Culture. - This plant may be increased by frowing the seeds obtained from abroad in small pots, filled with light sandy mould, in the spring, planting them in a hotbed, and watering them occasionally: when the plants are a few inches high, they should be carefully removed into other pots separately, replanting them in the hot-bed, giving them shade till re-rooted: they should afterwards have the management of other flovo plants. They afford variety and curiosity in flower collections with other plants.

SWIETLA, in Geography, a town of Bohemia, in the circle of Czaklaw. N. lat. 49° 35'. E. long. 15° 3'.

SWIFT, Johnson, in Biography, the celebrated dean of St. Patrick's, was descended from the younger branch of an ancient family in Yorkshire, of so small note and considerableness. His grandfather, Thomas Swift, was a clergyman, possessed of a good estate near Ros, in Herefordshire, but by his sufferings in the cause of Charles I. his fortune was ruined. He had ten sons, one of whom, named Jonathan, married Abigail Erick, a lady of good family in Leicestershire, with little or no fortune. He died young, about two years after his marriage, seven months before the birth of his only son, the subject of our article, and left his widow in very distressed circumstances. Being kindly invited by her husband's eldest brother, Godwin, she removed to his house in Dublin, where her son Jonathan was born on the 30th of November, 1667. When he was but a year old, he was carried away by his nurse, without the knowledge of his mother or kindred, to Whitby, whither he went to visit a friend, from whom he expected a legacy; and here he continued for almost three years, his nurse taking care of him, and teaching him to spell, so that he could read any chapter in the Bible before he was five years old. At the age of six he was sent to the school of Kilkenny, founded and endowed by the Ormond family; and at the age of fourteen he was admitted into the university of Dublin, where the expense of his education was defrayed by his uncle Godwin Swift, the eldest of his father's brothers, who had settled in Ireland. His uncle, who impaired his fortune by expensive projects, could afford him but a small pittance; and the strictness of his circumstances restrained the efforts of his genius, and discouraged his application to those branches of literature which his attention was directed. For mathematics, and the barbarous logic of that age, he had no taste; and as he had employed his hours of study in history and poetry, which were more suitable to his inclination, his proficiency had been so inconsiderable, that in his first examination for the degree of bachelor of arts, he was rejected on account of his disqualification for it. This disappointment, so far from inducing him to devote his time to college studies, served only to increase his dislike of them, and to occasion some reflections of contempt which occur in his writings; and therefore it was not in a manner very honourable to himself that he obtained this degree, which was conferred upon him "speciali gratia," or by favour rather than merit. In other pursuits adapted to his taste he was diligent, and employed eight hours a day in study. It was at this time, or at the age of nineteen, that he planned and partly executed his "Tale of a Tub," in which he displayed an uncommon second of miscellaneous reading. Soon after this his uncle Godwin died; and the incompetent support he then continued to enjoy was derived from the bounty of another uncle (William), whose circumstances would not allow any very liberal contribution. In possession of a scanty income derived from this source, he formed some expectations of additional assistance from a cousin, named Willoughby Swift, the eldest son of his uncle Godwin, who was then a considerable merchant at Lisbon. This cousin, hearing of his destitute condition, sent him a supply; the bearer of which was an honest tar, who declared receiving any reward for his trouble; alleging, "that he would do more than that for good master Willoughby." From this time he never knew what it was to want any thing in his purse.

Swift was now in his twenty-first year, altogether without prospect of advancement either in the church or in any secular department, without any great reputation as a scholar, from the disgraceful manner in which he obtained his degree, and with a spleenetic, morose temper, occasioned, or at least aggravated, by his dependent, penurious, and distressing circumstances, and disqualifying him for making personal friends. Nevertheless, it is to these circumstances, says one of his biographers, that the world owes a "Swift," and the want of money, want of learning, want of friends. His poverty and his pride were the subordinates guards of his virtue at college; and hence it happened that during his residence there, no flaw was to be found in his moral character, however low his talents and attainments might be rated. In 1688, being then in his twenty-fifth year, Swift left Ireland, and determined to visit his mother, who had found an asylum, in her state of penury and distresses, among some of her relations in Leicestershire. His mode of travelling was that of a pedestrian, with an occasional receipt, if the weather proved unfavourable, in a carrier's wagon.
SWIFT.

His mother, altogether dependent, could afford him no permanent protection and affiance. But she was related to the lady of Sir William Temple, who then lived in retirement at Moor Park in Surry; and his father had been the intimate friend of Godwin Swift. To him, therefore, Swift was advised to apply; and by him he was kindly received, continuing with him, as an inmate, at Moor Park and Shenhe for two years. This circumstance greatly contributed to the prosperous events of his future life. In the company and conversation of Sir William Temple, he made considerable improvement, and was actually employed by him in the revision and correction of his works; and by him he was introduced to King William, and had repeated opportunities of intercourse with him. The king offered him a captain’s commission in the horse; but he had no disposition for engaging in the military profession. The church was his choice, and hopes were entertained of his majesty’s favour to him in this way, but they were never gratified. He fought relief at this time from a disorder of the stomach, which occasioned such fits of giddiness that occasionally afflicted him, till they destroyed his reason, by a visit to Ireland, but deriving no benefit from this excursion, he returned to Sir William Temple’s, and renewed his studies. In the year 1692, he made a journey to Oxford, with a view of taking his master’s degree, hoping thus to obtrude his disgrace at Dublin. Here he was treated with great civility, and obtained the honour of which he was desirous on the 5th of July in the same year. After paying a visit to his mother, he returned to Moor Park, where he remained for two years; but finding no disposition in Sir William Temple to promote his settlement in the world, he left him in 1694, not without some tokens of displeasure. During his residence at Moor Park, he received frequent remittances from his uncle William, and his cousin William Swift. In the above-mentioned year, he went over to Ireland, and took orders in September, being then about twenty-seven years old. Soon after lord Capel, then lord-deputy of Ireland, to whom he had been recommended, gave him the prebend of Kilroot, in the diocese of Connor, worth about 100l. a year. During his retirement in this part of Ireland, he received various intimations that Sir William Temple of the rest of the benefit had faltered from him, his departure, and that he was sinking under infirmities, he much wished his return. A kind letter from Sir William himself confirmed these previous intimations, and he immediately determined upon returning to England. Having resigned his Irish prebend, he, very much to the honour of his benevolence, procured the presentation for an old incumbent nearly 60 years of age, who was no less grateful than Swift was generous. With about 80l. in his pocket, the whole flock which he then possessed, he embarked for England, and arrived at Moor Park in the year 1697. In this situation he remained about four years, in the greatest harmony, with tokens of mutual confidence and esteem, till the death of Sir William in 1699, who bequeathed to him a pecuniary legacy and his MSS. During this period of his life, Swift diligently prosecuted his studies, and regularly discharged his clerical functions in the family. He also became preceptor to a young lady, niece to Sir William Temple, who resided at the house; and at the same time Miss Johnson, afterward well known by the name of Stella, parlor of the benefit had faltered from him. Miss Johnson was daughter to Sir William’s Stewart, and being at that time about fourteen years of age, beautiful in her person, and possessed of fine talents, Swift took great delight in cultivating and forming her mind. At this time he also wrote his famous digresses, found in the “Tale of a Tub,” and the “Battle of the Books,” in honor of his great and learned friend. From the MSS. of Sir William Temple, Swift selected two volumes of letters, which he published, with a dedication to King William; to whom he also addressed a memorial, reminding him of the promise given by his majesty to the deceased, that the first vacant prebend of Canterbury or of Westminster should be conferred on himself; but no farther notice of him was ever taken by the king. Failing in his expectations from this quarter, he accepted an invitation from the earl of Berkeley, appointed one of the lords-justices in Ireland, to accompany him in the quality of chaplain and private secretary. Upon their arrival at Dublin, the earl was persuaded to take a secretary; and as his lordship intended to present his chaplain to the deanery of Derry, just become vacant, Swift was again disengaged by an application which secured that preferment to another person; so that he was put off with the livings of Laracor and Rathbeggin, in the diocese of Meath, which conjunctly were not of half or one-third the value of the deanery. The effect of these disapprobations was the increase of that irritability and misanthropy, which so strongly marked in Swift’s writings, and in his general conduct. Swift continued in the family of Berkeley during that nobleman’s stay in Ireland; and it was at this time that his true humorous vein in poetry began to display itself in several little pieces, written for the private amusement of the earl’s family. After lord Berkeley’s removal from Ireland, Swift went to reside at Laracor, where he continued for some time in the strict and constant discharge of his duty, occasionally diversifying into strains of humour. Soon after his settlement at Laracor, Swift is called “Stella” to Ireland; and the same, accompanied by another lady of the name of Dingley, who was related to the family of the Temples. These ladies occasionally resided in the parsonage-house when Swift was absent; but they were never known to lodge in the same house, nor to be each other without a witness. This mysterious connexion lapsed till her death, and he usually celebrated her birthday by verses, exhibiting almost the only strokes of tenderness that have ever fallen from his pen. Ambition now took full possession of his mind; and under the influence of this passion, he abandoned the duties of his parish, and the charming conversation of the amiable Stella, in hope of finding some favourable opportunity of distinguishing himself and pushing his fortune in the world. In 1701, being in his thirty-fourth year, he published his first political tract, without his name, entitled, “A Discourse of the Conquests and Difficulties in Athens and Rome,” the main scope of which seems to have been to bring discredit upon the impeachments then carrying on by the house of commons against some of the whig-leaders, to which party Swift was then attached. Upon the accession of queen Anne, when Swift found upon the throne in his next visit to London, his friends were in power, and he had gratified them by the fore-mentioned publication. He declined, however, all overtures made to him by the heads of the whig-gift party, and after some time determined to have no concern in their affairs. For several years he kept himself neutral, and abstained from meddling in politics. Finding that he could be of use in his political capacity, he turned his thoughts to other matters; resided on his living for the greatest part of the year, performing his episcopal duties, and therewithout ever employing his pen, except in writing sermons. In 1709, however, he published his “Meditation on a Broomstick,” in which he was much cenured on account of the ridicule contained in it of the fable and manner of so great and pious a man as Mr. Boyle, though it has been said that it was not
his intention to ridicule Mr. Boyle, but merely to furnish occasion for much innocent mirth on lady Berkeley's enthusiastic and simplicity of heart, and to exonerate himself from the task of reading to her writings, which were not at all suited to his taste. In the same year he also published the "Critical Essay on the Faculties of the Mind." In 1704 it was published, anonymously, the "Tale of a Tub," known to be his composition, though never avowed by him, a work which learned judges have pronounced to be rather indecorous than irreligious. The "Battle of the Books," printed with the former, is a burlesque composition of ancient and modern authors, to the disadvantage of the latter. The prominent object of ridicule is Dryden; but this poet was of too high a class to be permanently injured by Swift's wit. In 1708 he appeared as a professed author, by the publication of four different works. The first of these, entitled "The Sentiments of a Church-of-England Man with respect to Religion and Government," appeared on a change in the ministry; and this, together with the "Letter concerning the Sacramental Teft," afforded full proof of his adherence to the principles of the Tories. In his "Argument against the Abolition of Christianty," he exhibits a spirit of the age, with which the author is almost unsullied. His other piece was a ridicule of astrology, under the title of "Predictions for the Year 1708," by Isaac Bickerstaff, Esq., the popularity of which induced Steele to borrow the name for his Tatler. In the following year he wrote a serious work, entitled "A Project for the Advancement of the Christian Religion," dedicated to lady Berkeley, for whom he seems to have entertained an affectionate respect, and written (as Dr. Johnson says) with sprightliness and eloquence. Upon his return to Ireland he cultivated an intimacy with Addison, then secretary to the earl of Wharton, lord lieutenant; but, as for himself, he had no prospect of advancement, till the Tories came into power, in 1710. In a commission on the Irish prelacy for soliciting the queen to remit to the clergy of Ireland the first-fruits and twentieths, payable to the crown, he became acquainted with Harley, afterwards earl of Oxford, and secretary St. John, afterwards lord Bolingbroke; and having gained their confidence, he became one of the fifteen members of administration and their supporters, who called themselves "brothers," and dined weekly at one another's houses. He wrote a number of papers in the "Examiner," concerning the late administration, but, as Dr. Johnson thinks, though he exerted his powers both of argument and wit, he did not in the latter equal the papers in which Addison opposed him. He published at this time "A Letter to the Océbon Club," a set of Tory country gentlemen, who wished to stimulate Harley to more vigorous measures, and his address had the effect which he proposed of preventing cabals against his party.

Deeply immersed as he was in politics, he still adhered to the cause of literature, and in 1711 published "A Proposal for correcting, improving, and ascertaining the English Tongue," in a letter to the earl of Oxford. The institution of an academy for settling the language was a part of his project. Towards the close of the year 1711, he published the most celebrated of his political tracts, entitled "The Conduct of the Allies." This work, which was designed to disprove the nation to peace, was much applauded, and furnished the Tory members with all their arguments in parliament. The same strain of argument was pursed in his "Reflections on the Barrier Treaty," published in the following year. He also printed "Remarks on the Bishop of Sarum's Introduction to his Third Volume of the History of the Reformation," written by Burnet to excite in the nation an alarm of popery. In these remarks, Swift indulged the rancour of his personal aversion to that prelate. It has been observed of Swift, that no man of letters was more assiduous and maintained so much confuseness, as he did, in his association with men of power. The services he rendered them induced them to gratify his pride in this respect. When Harley once sent him by his secretary 50l., he returned it with a letter of protestation and complaint; but he afterwards accepted a draft of 1000l. upon the treasury, which he was prevented from receiving by the death of queen Anne. When Harley dired Swift to introduce Parnell to him, he declined doing it upon the principle, that a man of genius was superior to a man of high station; and he obliged the treasurer to walk with his staff of office from room to room, searching for Parnell, to requite the honour of his acquaintance.

Swift had been long aiming at a bishopric in England; and when a vacancy occurred, he was recommended to the queen by his ministerial friends; but archbishop Sharp, having infused into her mind fulspsicions of his faith, and other prejudices being raised against him, he was overlooked. The highest preferment which he enjoyed was that of chaplain of the deanery of St. Patrick's in Dublin, which he obtained in the year 1713, and which he retained for life.

In a pamphlet, published in the next year, anonymously, "The Public Spirit of the Whigs," in answer to Steele's "Cruïs," he reflected so severely and contemptuously on the Scots nation, that the peers of that nation went up in a body to the queen, and demanded reparation. A proclamation was issued, offering 300l. for the discovery of the author, and orders were given for the prosecution of the printer; but by some management, the storm was averted. The antipathy that prevailed between Oxford and Bolingbroke in the course of this year, cauèd him to be sent for, in order to reconcile the contending parties; but failing in his endeavours for this purpose, he withdrew from town, and wrote "Free Thoughts on the present State of Affairs," which it was not thought advisable to print; though they have since appeared among his works. The death of the queen terminated all contests among the Tory ministers, by annihilating their power; and Swift was constrained to take up his residence in a country which he always disliked.

On his return to Dublin, his haughty imperious temper was severely tried by the triumph of the Whigs, and the indig-nity with which he was treated. He, therefore, withdrew to the functions of his clerical office, and by the exercise of integrity and firmness, made many reforms in the chapter of St. Patrick's, and obtained an authority never before possessed by any one in his station. He opened his house twice a week to good company, and extended his acquaintance among the most cultivated and respectable of both sexes.

Mrs. Johnson, who had lodgings near the deanery, regulated his table on public days, though she sat at it merely as a guest. In 1716 he was privately married by Dr. Atthe, bishop of Clogher, to this lady, long known as his Stella; but before the event took place, he had formed another amorous connection, which was attended with circumstances more favourable than any other occurrence of his life. About the year 1712 he became acquainted, in London, with Miss Esther Vanhomrigh, an accomplished young lady of fortune, with a literary taste, which Swift took pleasure in cultivating by his influence, who he always became enamoured of his person, and actually made proposals of marriage to him. The flame on his part seems to have been mutual, and dictated his "Cadenus and Vanessa," the longest and most finished of his poems. Although he was engaged to Stella, he
he had not resolution to terminate the intercourse. When absent, he corresponded with her, and the followed him to Ireland. After his marriage with Stella, he still visited Vanella, and encouraged her hopes. Having questioned Stella whether or not she was really married, an answer was sent to her in the affirmative; and Stella sent her note to Swift, and went into the country, without seeing him. He went immediately to the house of Vanella, threw a paper on her table with a very indignant aspect, and then left her without uttering a word. Thus their connection terminated. The shock was fatal to the lady, who died in 1724, leaving in charge to her executors to publish all the letters that had passed between Swift and herself, together with the poem of "Cadenus and Vanessa." The poem was published, but the letters were suppressed.

In 1730, the dean of St. Patrick's claimed an interest in the regard of his countrymen, by publishing a pamphlet, entitled "A Proposal for the universal Use of Irish Manufactures." In 1734 he resumed his political character, by exerting all his powers for defeating a scheme for supplying the currency of that country by copper money, a pernicious plan of Wood of Wolverhampton having obtained a patent for the purpose. With this view he wrote a series of letters under the name of "M. B. Draper," which caused the coin to be universally refuted, to the great displeasure of the Irish government, which offered a large reward for the discovery of the author. The only person with whom Swift had entrusted the secret was his butler, who had transcribed the papers. This man, being absent from home one night, was surprised of having betrayed his master. On his return he was ordered to fling off his livery, and to quit the house: "I know (said he) that I am in your power, but for that reason I will not bear either your insolence or neglect." The butler, who had been drinking all night, confessed his fault, and intreated forgiveness; but the dean was inexorable. He was dismissed with disgrace, nor received again till the term of the offered reward expired. The dean rewarded his fidelity by making him verger of St. Patrick's; but he served his master still as butler. Thus government was baffled, the Draper triumphed, and the dean became the idol of the Irish nation.

In 1736 he published his "Gulliver's Travels," which was the product of spleen, as the author himself affirms; for in a letter to his friend Pope, he declares, in reference to this work, "the chief end I propose, in all my labours, is to vex the world rather than divert it."—"I have combated all nations, professions, and communities, and all my love is toward individuals."—Upon this grand foundation of misanthropy, though not in Timon's manner, the whole building of my travels is erected, and I will never have peace of mind till all honest men are of my opinion." These declarations are fully authenticated by the Travels themselves, which are, upon the whole, an outrageous satire on mankind, though the jujfns of many of its stokes cannot be denied. Some of the pictures are also highly disgusting, and others violate the probability of fiction; yet it is a work that will always be read.

In the same year, Swift, being in England, published three volumes of Miscellanea. In conjunction with Pope, to whom he relinquished the whole profits; for he seems never to have regarded his literary exertions as objects of pecuniary emolument.

On the death of George I. in 1727, Swift paid his duty to the new king and queen; he also paid his court to the favourite, Mrs. Howard; but eventually he gained nothing, and always afterwards spoke of queen Caroline with malignity. His Stell had been long languishing in a state of decline, her complaint being probably mental, on account of her extraordinary situation, combined with her bodily malady. Denied the honour and reputation of being his wife, her life was rendered intolerable to any female of spirit and delicacy. When in the ruined state of her health he offered to acknowledge her, she replied, "It is too late!" Another narrative is much less honourable to the character of Swift; this is, that within a few days of her dissolution, she adjured the dean, by their mutual friends, not to deny her the satisfaction of dying his acknowledged wife, though she had not lived as such; and that he turned upon his heels, left the room in silence, and never saw her afterwards. She died in January, 1728, bequeathing her fortune, in her own name, to charitable uses. Notwithstanding the doubts that have been thrown upon the validity of the marriage, the proof of it seems to be incontrovertible. They were probably suggested by some determined pamphlets, who wished to vindicate his conduct with respect both to this lady and Mrs. Vannanourgh; but each of these causes fixes an indelible blot on his memory, nor can any talents he polished or popularity he acquired, ever efface it.

The death of Stella very much afflicted Swift, though afterwards continued to vent his rancorous feelings in various effusions, both in prose and verse, on public topics. As an Irish patriot, anxious to meliorate the condition of the poor, he distinguished himself; and with this view he devoted a third of his income to charity. The most finished and interesting of his poems, written about this time, was the "Veres on his own Death," formed on a misanthropic maxim of Dacier. Having indulged his hatred of the Pretender in a bitter poem, in which he introduced the name of a counsellor, Bettefworth, who was obnoxious to him as an active leader in the Whig party, in Dublin, he was threatened with corporal retaliation; but his popularity was such, that the inhabitants of St. Patrick's district resolved to embody in his defence. In other instances he made little discrimination in the failures which he circulated; and such was the malignity of his temper, that it manifested itself in a kind of declared hostility against all mankind, a few of his own favourites excepted. At this time his most familiar associates were selected from the inferior classes, and especially from among people, who were always ready to administer obsequious flattery. In 1747 his constitution sustained a shock from a fever of phlegmes, to which, as well as deafness, he was habitually subject; so that after this period he undertook no work that required much thought or labour. It is hardly necessary to mention such pieces as his "Polite Conversation," and "Directions for Servants," which may be reckoned among his later publications. Whilst his bodily infirmities increased, his mind also decayed, and a gradual decline of reason, which he had long dreaded, settled into abysmic idiocy. His irascibility also increased, and at length he was a torment to himself and to all about him. During the violent pain which accompanied a tumour in one eye, it was with difficulty that he was prevented from tearing it out. A total failure of speech for some months preceded his death, which happened in October, 1744, in his 78th year. He bequeathed the greatest part of his property to a hospital for lunatics and idiots, the intention of which he had announced in the verse on his own death,

"To flee by one satiric touch, 
No nation wanted it to much."

He was buried in St. Patrick's cathedral, under a monument, for which he wrote a Latin epitaph; one clause of which displays very forcibly the state of his own feelings:

"Of
“Ubi fava indignatio ulterior cor lacerae nequit.” His predominant temper and distinguishing character are strongly marked in his life and writings. We shall select some sketches of both from the portraits furnished by his biographers. “A stern inflexible temper, and pride in a supreme degree, were the balsam of his character,” on which were built frugality, sincerity, integrity, and freedom from all mean jealousies; but alloyed with arrogance, implacability, cant and affectation of giving pain, and total want of candour. Numerous are the anecdotes of his rudeness and petulance in society, some of which were of a kind that meanest alone could tolerate. Of his obdurate and unfeeling nature, many more examples might be adduced, if those already given were not more than sufficient.

“As a writer, Swift was original, and probably will always remain unparaleled. In wit, he stands first in the walk of grave irony, maintained with such an air of serious simplicity, that it would deceive any reader not aware of his drift. He also boasts in ludicrous kind of being, with which his poems are abundantly interspersed, but which too often deviate into offensive grossness. Indeed it is remarkable, that so fatuously nice, should take a pleasure in descriptions full of physical impurity, and which cannot be contemplated without absolute disgust. His style in verse is the most perfect example of easy familiarity that the language affords; and his readiness in rhyme is astonishing, the most uncommon resolutions of sounds coming as it were spontaneously, in words the best adapted to the occasion. That he was capable of high polish and elegance, some of his pieces sufficiently prove; but the humorous, familiar, and farcical, was his habitual taste. His style in prose has been held up as a model of clearness, purity, and simplicity; it is, however, void of all the characters of genius, and has only the common merit of expressing the author’s meaning with perfect precision. Were Swift to revive, he would probably attain little distinction as a didactic or argumentative writer; but in wit and humour he certainly would not find a rival. He has secured a lasting place among the chiefs of English literature; and his name is still honoured in Ireland as a patriot, with a fervour that excites and almost panegyrizes his defects.”


SWIFT, in Geography, a river of England, which rises in the county of Leicestershire, and runs into the Avon, near Rugby, in Warwickshire.

SWIFT’s Creek, a river of Virginia, which runs into the Appamatax, N. lat. 37° 20’. W. long. 77° 57’.

SWIFT, in Ornithology. See SWALLOW.

SWIFT, in Zoology. See SWALLOW.

SWITTER, a rope used to confine the bars of the captnets in their sockets, while the men are heaving it about; for which purpose it is passed through holes in the extremities of the bars, so as to strain them firmly together like the spokes of a wheel, which is accordingly called a swifting.

SWITTERS are also a strong rope sometimes used to encircle a boat longitudinally, as well as to strengthen and defend her sides, so as to enable her the better to resist the imprefion of other boats which may run against her occasionally. It is usually fixed about a foot under the boat’s upper edge or gunnel.

SWITTERS are likewise two thongs fixed on the starboard and larboard side of the lower mats, above all the other thongs, as an additional security to the mats.

SWITTERING OF THROBS, denotes stretching of them by tackles, to prevent any future extension.

SWITTERING DESCENT, Line of the. See CYCLOID and DESCENT.

SWIFTING OF A SHIP. See SWITTER.

SWIG, or SWigo, in Mathemata, a name given by farmers, probably by corruption from youging a pulley with ropes that are not parallel. When the directions of the ropes of pulleys are oblique, the forces applied to them require to be modified accordingly. Thus, if two threads be attached to a weight, and pulled over two pulleys fixed at a distance from each other, so that two equal weights may be attached to their extremities, the depression of the first weight below either pulley will be to its distance from the pulley, in the same proportion as half of the weight to either of the other weights; and if, instead of having a weight attached to it, one end of a thread be fixed to a firm obstacle, the effect will be precisely the same. See PULLY.

SWIGAN, in Geography, a town of Bohemia, in the circle of Bohemia; 13 miles N.N.E. of Jung-Buntzel.

SWIGGING, a particular way of caressing rams.

The operation is performed by throwing the creature on its back, in which posture he is held; then a string is drawn about his teatsicles as tight as possible, and fixing it there, the part is anointed with fresh butter. The beast is then left to feed, and in two or three days the teatsicles grow so rotten, as to fall off with the string, or may be pulled away with a small force. Boyle’s Works, 4th. vol. i. p. 87.

SWIGGING-Off, in Rigging, denotes pulling upon the middle of a tight rope that is made fast at both ends.

SWIHAAU, in Geography, a town of Bohemia, in the circle of Pilzen; 18 miles S.S.W. of Pilzen.

SWILL, in Rural Economy, a term applied to the wash used for swine; it is also applied to a vessel to wash in, standing on three feet, a fort of shallow tub.

SWILL-THAB, a term applied to a fort of hog-tub.

SWILLY, Lousha, in Geography, a large bay of the county of Donegal, Ireland, as a patriot, with a fervour that excites and almost panegyrizes his effects.”


SWILLY, in Geography, a small island or rock in the South ocean, about 15 miles S. from the South Cape of New Holland, surrounded with rocks and shoals. B. lat. 43° 55’ E. long. 149° 40’.

SWIMMING, the act, or art, of sustaining the body in water, and of advancing in it by the motion of the arms, legs, &c. See MUSCLE.

Man alone learns to swim; all other perfect animals seem to take it naturally; though several of the imperfect swim not at all.

Among the ancient Greeks and Romans, swimming must be essential a part of the discipline of their youth, that to reprove a man perfectly rude and uneducated, they used to say proverbially, that he had neither learned to read nor to swim.

In fishes, it is the tail that is the grand instrument of swimming, not the fins, as has been generally imagined: for this reason, fishes are more strong and muscular in that part than in all the rest of their body; according as we find it in all other animals; the motive parts of which are still the
SWI

the strongest, as the thighs of men for walking, the pectoral muscles of birds for flight, &c.

The manner in which fishes row themselves forwards by the tail, is well explained by Borelli, De Motu Animal. part I. cap. 23. The fins of fishes serve only to keep the body well poised and balanced, and to prevent vacillation. See Air-Bladder, and Swimming of Fish.

Of swimming, a curious piece in French, called "L'Art de Nager," the art of swimming, demonstrated by figures. Before him, Everard Digby, an Englishman, and Nicholas Winman, a Dutchman, had also laid down the rules of this art: Thevenot has done little more than copy from them. Had he but read, with half that application, Borelli's treatise "De Motu Animalium," he would fearlessly have maintained, as he has done, that men would swim naturally, like other animals, if they were not prevented by fear, which magnifies their danger. We have abundant experience against this: throw any brute, newly born, into a river, and it swims; throw an infant in before it is yet capable of fear, and it swims not, but is drowned. The reason is, that the human machine differs very notably in its structure and configuration from that of brutes; and particularly, which is very extraordinary, in the situation of its centre of gravity. In man, the head is exceedingly heavy, with regard to the rest of the body; by reason the head is furnished with a very great quantity of brain, and has, besides, a deal of flesh and bones, and no cavities only filled with air; so that the head, emerging under water by its own gravity, the nose and ears are soon filled: thus the heavy carrying down the light, the man is soon drowned and lost. But in brutes it is otherwise: for the head, here, having but little brain, and there being abundance of sinues therein; its weight, with regard to the rest of the body, is much less considerable; so that they are easily able to keep their nose above water; and thus respiring freely, are out of danger of being drowned, on the principles of hydrostics.

In effect, the art of swimming, which is no otherwise to be acquired but by exercise, consists principally in keeping the head above water, so that the nose and mouth being at liberty, respiration may be carried on: for as to the feet and hands, it is enough to stir them, and to use them as oars to conduct the vessel.

Swimming of Fish. The swimming of fish, in general, is greatly assisted by their air-bladder. Those kinds which have not this bladder, either have regular lungs, and contain air in them, as is the case in the cetaceous fishes; or they have remarkably thin and flat bodies, as the rays and thornbacks, and the pleuronectes; or remarkably long and flexuous ones, as the petromyzon; and by these means are capable of easy flexuous motions, which, with the help of the fins, thrust them, any way at pleasure; though their bodies are not so nicely poised, as to the weight of the water, as those of such fish as have the assistance of these air-vessels.

It has been supposed by some, that the motion of fish in the water depends principally upon the pectoral fins, but this is easily proved false by experiment: for if the pectoral fins of a fish be cut off, and it be again put into the water, it will be found to move forward or sidewise, upward and down, as well as it did when it had them on. If a fish be carefully observed, while swimming in a basin of clear water, it will be found not to keep these pectoral fins constantly expanded, but only to open them at such time as it would float or change its course, this seeming to be their principal, if not their only use. The pectoral and ventral fins, in the common

fins of the cathetoplateous or compressed form, serve in the same manner in keeping the fish still, and serve scarcely any other motion than that towards the bottom; so that this motion of the fish, which has been generally attributed to their fins, is almost wholly owing to the muscles, and to the equipoise of their air-bladder. The use of the pectoral and ventral fins is to keep the fish steady and upright in the water, is evident from the consequences of their loss:—if they are cut off, and the fish put again into the water, it cannot continue in its erect natural posture, but staggers about, and rolls from side to side. The fins of the back and anus are of great use to the keeping of the creature in its usual position, as is easily seen by cutting them off, and observing the motions of the fish afterwards.

Though a great deal depends on the motion of the muscles of the several parts of the body in the swimming of the fish, yet the tail, and those muscles which move the lower part of the body to which it is affixed, are the great instruments by which their swift motions in the water are performed. The moving of the tail, and that part of the body to which it adheres, backward and forward, or sideways any one way, throws the whole body of the fish strongly the contrary way; and even in swimming forward, the motion and direction are both greatly aided by the vibrations of this part, as may be experienced in the motion of a boat, which, when impelled forward, may be firmly guided by means of an oar held out at its side, as it is moved in the water as occasion directs. The dorsal muscle, and those of the lower part of the body between the fins and tail, are the principal that are used in the motion of the part, and these are therefore the most useful to the fish in swimming. The muscles of the body seem to have the principal use in contracting the belly and the air-bladder. They have been supposed of use to move the belly-fins; but there are too many of them for such a purpose, and the fins have each its peculiar muscle, fully sufficient to the business. The use of the tail in swimming is easily seen, by cutting it off, and committing the fish to the water without it, in which case it is a most helpless creature. See Air-Bladder, and Fish.

Swimming of Giddiness in the Head, a disease sometimes afflicting men and animals, and which is not frequently a troublesome and dangerous disorder in these parts of the world. Where the brain is affected with a fort of irritation or inflammatory state in some of its parts, the complaint is often the title of "foolishness" or "frenzy" given to it; but when there is nothing of this kind, but merely a sort of reeling and unsteadiness in the gait and manner of the animals, it is mostly of the nature of staggerers.

The cure or removal of the complaint is commonly to be managed in the manner of one or other of these disorders, according as the nature or the appearance may be, both regard to medicine and diet or food, which is proper and necessary. See Staggerers.

Swimming of Salt-Water, in Agriculture, the practice of floating it in a tub or other vessel full of water, nearly full of salt-water, in order to prepare it for use, by having the light imperfections removed. The methods of effecting this are performed somewhat differently in different districts. In Essex and some others, common water, in which a certain quantity of lime has been mixed, or salt-water, is poured into a tub which is capable of containing twenty or thirty gallons; into this water the wheat is put, until the whole is full within about three or four inches of the brim; the whole is then well stirred together with a flote stick, &c. which is better, a light shovel. All the light and imperfect
of defective grains naturally rise and swim upon the surface of the water; these are repeatedly taken off by a skimmer, until few or none remain behind. The whole residue of the wheat, with the water, is then put together into a basket-fraiser, which is placed over another tub of similar size and capacity; the water passes freely through into the tub underneath, and the wheat left behind in the basket is emptied out upon the floor of the place where the operation is performed, whether it be brick, clay, or any other. When a sufficient quantity for the next day’s sawing is thus prepared, the heap is spread out and levelled to about three or four inches in depth or thickens, on to such a thickens as may be thought the most proper and convenient, and then some well-flaked lime is evenly sifted over it; after which it is stirred over and over again, until the line and wetted wheat be as uniformly mixed as possible, and the grain sufficiently dried to be capable of being sown on the following morning. In some places, different saline or other substances are diffused in or mixed with the water used in swimming the wheat, but this is not a very common practice.

The useful practice of swimming wheat is now, however, a good deal left off in many districts, and other modes substituted in its stead, such as sprinkling and liming it only on the floor, the use of medicated and other feeds, &c. as have been shewn under the proper heads. See STEARING OF SAWD-GRAIN AND SEEDS.

By the practice of swimming wheat for feed, there would seem to be much advantage gained; as, from all the light defective grains being taken away, there is no danger of laying that which is improper for affording a strong healthy vegetation and growth; and besides, such good and perfect washing may have the effect of removing any sort of minute contagion that may be present, as well as all sorts of light feeds of the weed kind that may be among the wheat.

SWINCANY, in Geography, a town of Lithuania; 39 miles N.N.E. of Wilna.

SWINDON, a respectable market-town in the hundred of Kingbridge, Wilts., England, is situated 36 miles N. from Salisbury, and 87 miles W. from London. From the silence of our early historians respecting this town, it is presumed to have been of anciently of little importance, and no way connected with any remarkable civil or military event.

The name, however, is at least coeval with the Conquest, “Swinonde” being the appellation by which it is distinguished in Domedal-book. According to the parliamentary returns of the year 1811, the parish contained 260 houses, and 1341 inhabitants. There is no particular trade carried on here; but as a number of persons of independent fortune reside in the town, their constant intercourse gives a degree of life to the place, while, at the same time, their mansions contribute materially to ornament it. The pursuits of husbandry, and the working of some extensive quarries in the vicinity, afford employment for the most of the people. The stones raised from these quarries are usually of great magnitude; and, in respect to the quality of beauty and durability, scarcely yield, when cut, to the most celebrated Portland stone. A market is held every Monday for corn and other commodities; and on every alternate Monday for cattle. Fairs are also held annually. The petty fairs for the Swindon division of the hundred are held here. The parish church stands at the south-east end of the town, is neatly fitted up in the interior, and contains several monuments; one of which, on the east side of the north aisle, commemorates Mrs. Millecent Neate, who died July 9, 1764, in the 73rd year of her age. Adjoining the churchyard, on the south-west, is a mill, worked by water cons-
ducted by pipes from a well called Church-Well Pond. At the extremity of the horizontal pipes another is fixed, vertically, in height about ten feet, through which the water is raised to a trough, whence it falls upon the mill-wheel, and turns it with perfect regularity. A respectable free-school, situated in Newport-street, was established in 1764, for the instruction of twenty boys and five girls in reading, writing, and arithmetic, and is supported by voluntary contributions.

Swindon-House, a seat of the family of Goddard, stands at a short distance from the north side of the church-yard. It is a neat, modern edifice, with a fine lawn, and extensive pleasure-grounds attached to it.

In a field at Brome, a small hamlet to the northward of Swindon, is an upright stone, called Long-stone, ten feet in height; and, in the meadow below, is a range of smaller stones, placed in a straight line. These are conjectured to be remains of a Druidical work. Beauteis of England and Wales, vol. xix. Wiltshire, by J. Britton, F.S.A.

SWINE, in Agriculture, a well-known animal of the quadruped kind, which is of much importance to the farmer in many situations; and which, under proper modes of management in respect to breeding, rearing, feeding, and fattening, often affords a good profit. See Sul.

It is well known that the hog is a native of all the temperate climates of the old world, but was not found in America, until introduced by the first discoverers, the Spaniards, whose white breed has had a wonderful increase both on the American continent and on the islands. But it has been affected by naturalists, that swine are not indigenous to these islands; probably, however, without any sufficient authority. They are, however, no longer found wild either here or in France. But the European wild boar, the original stock of our domestic breed, is still to be found in the forests of Germany, and other countries on the continent, being generally preferred as a beast of chase. According to the writer of a late Treatise on Live-Stock, he has a dark brindled, grey colour, sometimes nearly black, or of a dunkey yellow, with longitudinal stripes, like those of the domestic kind, called corders dappled. He is smaller than the tame hog, with upright, wide ears, long powerful snout, large head and shoulders, high crest, deep short body, and thin hinder-quarters, and endowed with considerable activity. The African hog is red or sandy in colour, with a small head, long, slender pricked ears, soft and short hair, and a long tail, touching the ground. But the writer is not informed whether this be the same variety as that which is used in this country as a croft, under the name of the African. He farther states, too, that the Ethiopian hog has wattles under the eyes, is large, and in a wild state. And that the Cape Verde hog, another African variety, is also large, with more length than the former. It is added, likewise, that the South American hog, with the white, have been long well known in this country, as a croft for fines of bone and quickness of proof. But whether the Portuguese, of nearly similar form with the last, be only a variety of that species, he is not informed, or whence we derive the large, thick-hided tomy. In Batavia, he affords, they have long used the tomy, or croft. And he has heard that our sandy or rufous pigs are of Italian origin, and that the neighbourhood of Turin is celebrated for its excellent breed. The Bofian and Servian pigs, with which the markets of Vienna are supplied, if we may credit travellers, have the character, he contends, of being at once the hardest and the handiest in the world, and such as will stand travelling with the least fatigue.
However, in regard to the native pigs of Ireland, France, and Germany, at least such of them as he has seen, they are of the large, flat-hided, heavy-eared breed, with longer legs, and of still worfe form, but refembling our old breeds of York and Shropshire. And it is further stated, that the hogs of Curdlan, in Asia, are of the largest size and weight. Also, that Articole and other ancient writers mention a peculiar variety, the thin skin of Inarva, which di not divide the hoof. Mafcal says, this whole-footed breed existed in his days in the neighbourhood of Windsor, and that they were a large and superior species; and, on enquiry, the first of the above writers finds some remains of this variety have been found in Berkshire of late years, but that they have now ceased to be a distinct variety, and a few individuals only of them are occasionally met with.

The variety of hog with undivided hoofs occurs, it is said, in the canton of Neorot, not far from Safetn, in the island of Sardinia.

Indeed it may be noticed, that there is evidently much diversity in these animals, in different situations and circumstances, which require to be particularly attended to by the farmer, as it is a point of much advantage in this, as well as all other sorts of live-stock, to have a good breed, for it will confantly pay better than those of the more inferior kinds. But, like most other descroptions of farm animals, they should probably, in some measure, be adapted to the nature of the keep, and the circumstances of the management under which the farm is conducted. They should poiffet, as much as possibly, the points and properties mentioned below; which the farmer should never neglect or be indiffertent to in selecting them for his different ufe. The chief marks made ufe of in distinguishing the breeds of this animal, are those of the form or shape of the ear, and the quality of the hair. The pendulous hanging down, or lop-ear, and the coarse harfthair, are commonly ascribed to indicate large measures of size, and thickness of skin; while creft or prick-ears shew the size to be more small, but the animals more quick in feeding. And it has been observed by some of the older writers, that the smooth soft-haired pigs are most suitable for warm climates.

But the hog or swine, to be well formed, should not be too long, but full in the head and cheek; thick and rather short in the neck; fine in the bone; thick, plump, full and compact in the carcass; full in the quarters; fine and thin in the hide; and of a full size, according to the sort, whatever it may be; having a disposition to fatten well and expeditiously at an early age. Varro, and also Columella, however, describe what was considered in their time as the marks of a good hog, to be a small head, short legs, long bodies, large thighs and neck, and the bristles, particularly on the neck, thickfet, creft, and strong.

And it is observed by the author of the General Treatise on Cattle, that depth of carcass, lateral extension, breadth of the loin add breast, proportional length, moderate shortness of the legs, and subsidence of the gammons and fore-arms, are great essentils. These are qualities, he thinks, to produce a favourable balance in the account of keep, and a mass of weight which will pull the scale down. In proportion too as the animal is capacious in the loin and breast, it will be generally the vigour of his constitution; his legs will be thence properly extended, and be will have a bold and firm footing on the ground, to which, however, it is farther necessary, that his claws be upright, even, and found. He adds, however, that a good hog may have a coarse, long, ugly head and ear; and these may be safely claffed among the non-essentils; yet a short, handsome, sprightly head, with light, pointed, pendulous ears, of moderate fixe, are pleasing to the view, and may sometimes have a favourable effect in the market. For head and ears, the Ox- ford, or rather smaller Berkshire pigs, are good models; and for true shape, the improved Shropshire, Hereford and Gloucester. If colour deferve any consideration, he would prefer the light and candid and yellow-spotted, at least such skins appear far the most delicate when dead. In repels the skin of Inarva, gives a preference to the thick over the thin skin. And he remarks, that our belt bred pig are often thick-skinned, but such skin is tender, gleamous, shining, easy to matricate, even in the shape of rough crackling, and very nutritious; whereas to eat the cracking of thin-skinned pork, cafe-hardened by the action of fire, requires teeth equal to the division of block-tin. The health of swine is to be estimated by their cheerfulness, by the glosa upon their costs, and their skin being while unfree from eruption. It is an extremely unfavourable indica tion when the head is hung down, the fount approaching the earth like a fifth leg, and when the flanks heave and are hollow. If pigs bark (short) on being alarmed, it is an excellent sign of found health and good keep.

It may be observed, that the breeds or varieties of these animals are so extremely numerous, that almost every county or district of the kingdom is possessed of a particular kind. But they may be distinguished into the large and small sort, of the former of which, the following are the most notable breeds:—the Berkshire, the Hampshire, the Shropshire, the Gloucester, the Hereford, the Rutland, the Woodburns, the Wilthire, the Yorkshire, the Northampton, the Lincolnshire, the Norfolk, the Suffolk, the Essex, &c. And the principal difference in the breeding and rearing of these animals at present, are Berkshire, Hampshire, Shropshire, Gloucester, Hereford, Wilthire, Northampton, Lincolnshire, Yorkshire, Norfolk, Suffolk, Essex, and Suffolk of Surrey.

The Berkshire Breed. —This is a breed which is distinguished by being in general of a tawny, white, or red colour, spotted with black; large ear hanging over the eyes; thick, close, and well made in the body; legs short; small in the bone, having a disposition to fatten quickly; when well fed, the flesh is fine. The above county has been long famous for its breed of swine. But according to the author of the Treatise on Live-flock, the old breed is now so totally worn out, that he believes for many years past, no possibility has existed of obtaining a living model. They were described to him as being long and rather crooked-nouted; having large heavy ears; body long and thick, but not very deep; legs short, with much bone. They formed made great weights. But the new breed is, he maintains, lighter in the head and ear, shorter in the carcass, with somewhat less bone, and higher in the leg, in colour generally dark-spotted. He supposes that the Berkshire breeders have made a very judicious use of the pig breed by not repeating it to the degree of taking away all flage and power of growing fleshy, in their flock; and he believes they now mean to discontinue any further mixture. The breed, as it now stands, is about in the third class of pig, most excellent in all respects, but particularly as crofs for heavy flow-feeding forts. The small pork variety of Berk, and those of Oxfordshire, with small carcasses, short and handfome heads, appear to him to have descended from the Axford breed. On the whole it is a useful breed, that has extended itself from the district of Berkshire, its name, over most parts of the island; it is the fort mostly fattened at the distiller; it feeds upon great weight, and is good for either pork or bacon. The
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sort is supposed by many as the most hardy, both in respect to their nature, and the food on which they are fed. The Berkshire is, however, a sort of hog that requires constant good keep, declining fast under other circumstances.

The Hampshire Breed. — This is a kind of large hogs which is longer in the body and neck, but not of so compact a form as the Berkshire; they are mostly of a white colour, or spotted, and are well disposed to fatten, coming up to a great weight, when properly managed in respect to food. But the writer of the late work on Live-flock says, they are generally dark-spotted, some black, of a longer and flatter make than those of Berks, ears more pointed, head long and sharp, resembling the Essex. However, he speaks of them as they are found in the range of Basingstoke and Andover. They are generally, he says, bought up with the Berks flock, the dealers themselves being inattentive to any distinction between the two varieties. The goodness of the Hampshire hog is proverbial, and he has never observed in any breed greater or quicker proof.

The Shropshire breed is another large fort of hogs, which are found valuable where the keep is in sufficient abundance for their support. They are not so well formed as those of the Berkshire kind, or equal to them in their disposition to fatten, or to be supported on such cheap food. The standard colour of this breed, according to the above writer, is white or brindled; and that anterior to the late improvement, they might be looked upon as nearly as possible the original large breed of England. They are a breed of the largest size, flat-boned, deep and flat-furred, hair in rather wavy-haired, the ear large, head long, sharp and coarse, leg too long, loin, although very subtiliant, yet not sufficiently wide, considering the extent of the whole frame. With all these defects, they were, he says, ever excellent stock, and have been improved within the last fifteen years by the Berkshire crofs, which has reduced the length both of their legs and carcase, and rendered their heads lighter; in consequence the new variety, shewing the Berkshire spots and form, feeds quicker than the old fort of these animals. Shropshire has long been employed in breeding stores for the supply of the London feeders, and of the Exelex farmers, who thus turn their closers to the most profitable account.

The Gloucestershire Breed. — This is likewise a large breed, but inferior to either of the above, being tall and long in shape, and by no means so well formed. The colour is in general white. It has two wattles hanging from the throat. Mr. Marshall supposes this to be the prevailing breed of the island. It is said to be thinner in the skin than the Berkshire breed, and to require better forts of food. According to the above writer on Live-flock, this breed is a size under the Hereford fort, and a shorter and more truffled pig; there is also, he thinks, a handfome roundness of the bone and frame, which distinguishes this breed. Formerly it was used to feed many fandy pigs among them, and some with very heavy, thick ears, but they are not now so heavy-eared. They are, he says, good flock for any purpose.

The Herefordshire Breed. — This is also a large useful breed, but perhaps without possessing any advantage over those that have been described above. The same writer on Live-flock thinks it a variety of the Shropshire, or an intermixture, which cannot now be traced. He says they are shorter, have legs bone, and lighter heads; ears smaller, thinner, and more pointed; coats somewhat less harsh than those of Shropshire; and are quicker feeders; colour originally light. There may be found in this breed many individuals of the true fruit; they are generally good sound stock, full of growth, and assuredly among the most profitable bacon-hogs we have. They have been of late crossed with the Berkshire breed, of which the best of them did not, he thinks, lend any great need.

The Rutland Breed. — This is a large kind of swine, with the author of the Survey of Middlesex says is the largest in the island, met with at the village of that name, on the borders of Suffolk and Surrey. They feed to an extraordinary size, and weigh, at two years old, nearly double or triple the usual weight of other forts of hogs of that age. As large breeds pay the farmer the best in many cases, such a breed deserves to be attended to in the system of hog management.

The Large Spotted Wooburn Breed. — This is a breed introduced by the late duke of Bedford, being large in size and of various colours. It is hearty, well-formed, prolific fort, rising quickly to a large weight.

The Wiltsire breed is a long-bodied low hog, hollow about the shoulder, and high on the rump; middling, large pointed ears; round bone; light in colour. It is stated by the above writer on Live-flock, that of late years this breed has been crossed with the pug and the Berkshire forts, and that the new variety appeared to him smaller than the old breed, and darker in colour, spotted, with round carcase, handfome pug face, and some with prick-ears; and that this crofs is by no means a new thing. The boars originally made use of, were of the wild breed from Barbadoes, in colour red, or red spotted with black, which were sent from that island, more than fifty years since, by a gentleman to his relation at Axford, near Marlborough, and thence the variety produced were long called the Axford breed. Without doubt, he says, the Axford smaller variety, and part of the new Berkshire, originated in the same source.

The Yorkshire Breed. — This, in the old kind, was, it is said by the writer above cited, probably the worst large variety we had; extremely long-legged and weak-joined, their constitution not of the foundled fort; and bad fay-pigs in the winter feast; they were yet quicker feeders than some of the superior breeds. They have been improving, he thinks, some years from the Berkshire crofs, but are full inferior to the north-western flock, fetching a less price at market. Probably short-legged Gloucestershire boars might succede with this breed, or the entire adoption of Hereford flock might be attended with still more profit.

Besides these, there are some other breeds in different counties of a middle size.

The Northamptonshire Breed. — This breed was formerly, according to the above writer, a handfome, light-eared, white, deep-furred pig, with middling bone, and quick of proof; the breeders have since, he says, tried the new Leicester, and, if he is rightly informed, without success. They have again, it seems, returned to their old breed; adopted fome improving crofs, and at present breed mixed-sized well-shaped pigs, both for their own and the Buckinghamshire dairy farmers.

The Leicestershire breed is, in the original flock, large, deep and flat-furred, light-spotted, with rather handfome head and ear. The above writer on Live-flock is not informed whether the Bakewell variety has much merit in its own county.

Some improvements have been made in the Devonshire fort of hogs, it is said by the writer of the Agricultural Report of that district, by a crofs with the Leicestershire boar, which has much spread, and given a roundness to its frame.
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with a proportionable depth of body; its legs have also been shortened; a finer bone produced, with a disposition to look much better, when growing as a store, and to feed quicker and more kindly in the fly. By a farther crofs with the Chinese breed, these crofses have considerably reduced its size; but the advantages accruing therefrom, are the constitution and habits of a profitable animal, weighing, when 18 months old, and fattened to its frame, from 16 to 20 score per hog.

The Lincolnshire breed is a breed that was formerly, according to the above author, light-coloured and white, like those of Northamptonshire, many of them having curled and woolly coats. They are flint, he fay, middle-sized, quick-proving pigs.

The Norfolk breed is a small, short, up-eared, porking fort, various in colour, white, blue, bifi, friated; generally an inferior kind, which the same writer on Live-stock thinks it would be to the interest of that great corn county to improve; they are, however, of a thin-skinned, quick-proving kind. But in the vicinity of Lynn, and generally on the Lincoln side of the county, there is a larger-spedted variety of very good form and quality, which should be encouraged.

The Suffolk Breed.—This is a small, delicate, white fort of pig, which, the same writer says, has for many years had great reputation, and at this time, there is not only a strong prejudice in their favour in their own county, but they have many advocates outside of it. They are shorter, and more pig-formed than the Norfolk; and by their diff face and pendent belly, it may be supposed that the variety proceeded originally from the white Chinese. Some of the Suffolks are very handsome, and very regularly shaped; their defects are, he thinks, that they are great consumers in proportion to their small bulk, and that they produce little flesh. He supposes that the small Hampshire boar would be a profitable crofs for the sows of this breed.

The Essex breed is a fort which are up-eared, with long sharp heads; roach-backed; carcasses flat, long, and generally high upon the leg; bone not large; colour white, or black and white, bare of hair, quick feeders, but great consumers, and of an unquiet disposition. A mixture of the toonky with this old breed produced an improved and shorter variety, called the half-black, a very useful kind of pig.

This breed, called the Essex half-black, in the best forts of them, is thought in that district to be inferior to none in the kingdom. They feed remarkably quick, grow fast, are thin in the skin, and light in the bone and offal, and they are also an excellent quality of meat. The sows are good breeders. There are, in the said, a great many pigs bred and fattened in the above neighbourhood, and sent to market for jointed pork, weighing from fix to eight or ten stone, which weight they come to at five or six months old, without putting up: they have some bones given them as they run.

In other counties, also, there are many other varieties, which is unnecessary to mention here.

In respect to the varieties of these animals, Mr. Donaldson remarks, that the Berkshire and Hampshiring hogs are the largest; but that it is most probably from the Berkshire stock, that the greatest number of varieties of the country have sprung. And that they are of a very large size, the four quarters frequently weighing, when fat, not less than from 600 to 800 weight; the medium weight of the hams and bacon do not, however, exceed from 300 to 400 weight. The above writer speaks of a breed in the northern parts of Scotland, whose appearance, being very different from that of any other fort in the island, denotes them, it is thought, to have been the original breed of the country. They are small, ill-formed, bristly, wild-looking animals, and are very probably the remains of that breed, which we may suppose to have ranged through the forests and woody parts of the kingdom for ages in a state of nature.

It may be further noticed, too, that in the smaller breed of these animals, there is likewise much diversity or difference in regard to the size, as well as other qualities. But that the principal forts of them are these: the Chinese, the English white, the swing-tailed, &c.

The Chinese breed is a breed which is distinguished by the neck being thick; the body very close, compact, and well-formed; the legs very short, and the size small; the flesh delicate; the colour various, as black, white, brown, and tawny. This breed is particularly disposed to fatten in an expeditious manner, and has, in consequence, spread over a great part of the kingdom. It is most adapted for being used as pork; but is much too small for being used for bacon. It is miscible when not well rung.

The small white English breed is another breed of the small kind of hogs, that is met with in many districts; it is of a white colour, and well made in the body; short in the leg; the head and neck well formed, and the ears slouching a little downwards. It is well disposed to fatten, and perfectly hardy. It prevails much in the northern districts.

The swing-tailed breed is an useful fort of the smaller kind of hogs, that is hardy in its nature, and of considerable weight in proportion to its size.

It is, however, common for some farmers to prefer minid breeds, as being more beneficial than either of the large or small perfect breeds. Where this is the case, the Berkshire, with a crofs of the Chinese, has been found a very profitable fort, as being capable of feeding to a considerable weight with a moderate proportion of food, and is a short time.

It has been well remarked by the author of the Good Treatise on Cattle, that nothing can be more groundless than the common assertion, that there is no such thing as a breed in pigs, the only meaning of which is, he thinks, that the alligators have not taken the pains to seek it. The number of regular breeding counties is very considerable, and the peculiar characteristics of form, in each variety, are distinctly marked as in any other class of animals. That there are numberless intermixtures, that radical changes are introduced in the course of time, even those districts most prejudiced in favour of their own peculiar variety, and that in many counties, where a few only are bred for home use, they have no settled breed, is a common thing with every other species of cattle-stock and animals. There can, however, be no doubt, but that the difference of breed in this fort of live-stock, is as obvious as in that of most other kinds; and that in order to have good pigs, it is necessary to be attentive to the breed, or in the other forts of domestic animals. And it may be noticed, that in the breeding and crossing the different forts with the view of improvement, much care is requisite to adapt them to the nature of the different objects aimed at, on the principles that have been laid down in considering the nature of breeding animals for the purpose of the farm, in order to have them to the greatest advantage.
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... other proper kind should be selected for the purpose. And in providing hogs or swine for the purpose of breeding, they should constantly be well fed, and taken care of, as by being flouted in their food and neglected, their growth and healthy condition are considerably affected.

By some it has been observed, that in cafes where there is a certain vent for the flock produced, the breeder will be well repaid for growing and purchasing food in this view. And that breeding, in proportion to the greater trouble and risk, is more profitable than purchasing the fowls. Further, that if it be intended to breed for sale, in a frote flate, it is of the more conquence to procure a regular and well-shaped breed; as such will always meet a preference in the fair or market, especially if they are to be driven to the southern directions. The nature and size of the breed should depend upon the abundance or scarcity of food. In the former case, the large breeds are said by Mr. Knight to be the most profitable, from the circumstance of the difference in the proportions between the living and the dead profitable weight, being the least in the largest breeds.

It has likewise been suggested, that the best flock may be expected from the boar at his full growth, but not more than from three to five years old. And that no fows should be kept open for breeding, unless they have large capacious bellies. Being well fed from the teat, the fow was more prolific in nine months; and the he of the kind in which the strong tendency to fat increases the risk of bringing forth, probably the suffering her to breed as early and as quickly as possible may contribute to amend the defect. It is also hinted, that if a fow of this description would admit the boar the third, or within a few days after pigging, impelling her to the severe task of constant breeding and fucking, would double her sufficiently lean and roomy for the production of a good litter. It is probable, however, that the quality and size of the pigs would suffer. But some suppose it better to defer the fow's taking the boar till ten or twelve months old, as she becomes more strong, and affords better litters of pigs; and that the boar should always be a year old or more before he be put to the fow, as by this delay he attains a better growth, and is more vigorous.

It may be remarked in respect to the period of being with young, that in the fow it is about four months; and the usual produce is from about eight to ten or twelve pigs in the large, but more in the smaller breeds, which in general bring forth a greater number.

General Management and Stock-feeding.—In the ordinary management of swine, fows, after they have had two or three litters, may be killed; but no breeder should part with one, whilst she continues to bring large litters, and to rear them with safety, although custom often induces the farmer to kill such fows, and to sublimate others of not perhaps half the value in their places. In cafes where swine are made an object to the farmer, great care should be taken to have a good boar constantly along with the fows, in order that a proper succession of young pigs may be produced. And by this means the fows are likewise made to take the boar more expeditiously.

Farther, it has been observed by a late writer, that as there is great difficulty and expense attending the rearing of young pigs in cold seafons, the farmer should contrive as much as possible to have his litters early in the spring and autumn seafons, as about the end of March or beginning of April, and the latter end of July, August, or beginning of the following month; as at these periods much lefs lotts will be fulfilled in the death of the pigs, and lefs expence be incurred in food. The litters which are pigged in June, or the early part of the following month, should always be reared, as being highly profitable and advantageous. But it is seldom advisable to keep the late autumn litters, as the cold in the winter is almost sure to destroy many of them, and much lost thereby. With a late litter, it may, however, sometimes be beneficial to suffer them to fuckle and feed with the fow, the keeping being of the most forcing kind, during three or four months, from which management the most delicate pork might be provided at a farce lean.

In all cafes, however, great care should be taken that the fows, as they advance in their pregnancy, be lodged separately, lest their bellies be hurt by others lying upon them; and it is of still more consequence, that no other fow be within reach of them at the time of bringing forth, since in that case the pigs would most probably be devoured as they fall. The fows should also be attended in pigging with much care in order to preserve the pigs; and it may be necessary sometimes during three or four days afterwards. Such fows as have the unnatural propensity of devouring their young, should be well secured at the time, and be dispoled of as soon as possible, as they never do any good in keeping as breeders. It is found that dry, warm, and comfortable lodging is of almost as much importance as that of food; in this system of management, the fows and pigs not being turned abroad by any means in bad weather. The pigs may be weaned in about eight weeks, after which the fows may be shut up, feeding them well, and on the return of their milk, they will most finely express very plainly their desire of taking the boar. The fows require to be fed in an extraordinary manner while they are nursing, particularly if they have a number of pigs to support.

And in the pig system it is allo of much consequence, both in respect to economy in the labour of their attendance, and the raising a large proportion of manure, as well as the advantage of the hogs, to have regular and convenient piggeries upon an extensive scale, containing separate apartments for every description, with offices for boiling, steaming the food, and rowsage, and ciphers to contain wish for the animals. See Hog-By.

Allo in the management of these animals, it is of great utility and advantage to keep the different forts separate and distinct from each other, as the fows in pig, those with pigs, and the others according to their ages; as it is only in this way that they can be kept to the most profit and advantage, as most early.

It may be observed in regard to the food of this sort of farm-stock, that as the breeding of pigs is a businef that affords the farmer a considerable profit and advantage in various views, it is of essential importance that he be provided with suitable kinds of food in abundance for the support of the numerous fows that it will be neccessary for him to keep, and the great number of pigs that must be raised. Upon this being properly and effectually done, his success and advantage will in a great measure depend. The crops capable of being cultivated with the most benefit in this innation, are beans, peas, barley, buck-wheat, potatoes, carrots, parnips, Swedish turnips, cabbages, lettuces, clover, lucern, chicory, &c. The proportions in which these crops should be grown for this purpose must vary according to circumstances; as the kind of hogs, their extent, and the manner of dispoing of them; but whatever number may be kept, an equal proportion of root crops, and those of the grafs kind, will be requisite, with about half as much of the farrnaceous or grain kind, as those of the root fort; and a quantity of the luxuriant vegetable kind, fully in proportion to the number of hogs that are to be fed on such.
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such sorts of food. And that in the supplying of the hogs with food, a distinction is to be made according to the different kinds, in order that the fust may be made of the food. The fows considerably advanced in pig, and thofe with pigs, should be fed in a better manner than the store pigs. The former should be supplied with good wash twice or oftener in the day, and have a sufficient allowance of cabbages, potatoes, carrots, or other similar vegetables, so as to keep them in good condition; which is shown by the glossy of their coats. The fows with pigs should be kept with the litters in separate fives, and be still better fed than those in pig. Where dairying is practiced, the wash of that kind which has been prepared for the purpose, while the dairying was at the height, in brick cellars, constructed for receiving it from the dairy, must be given them, with food of the root kind, such as carrots, parsnips, potatoes, and cabbages, in as large proportions as they will consume them, in order that the pigs may be properly supported and kept in condition. But where the business of dairying is not carried on so as to provide wash of that sort, meal of some kind or other must. Mr. Young thinks, be had recourse to for the making of wash, by mixing it with water, which, in the summer season, will be sufficient for their support; and in winter it must be blended with the different sorts of roots prepared by boiling, or, where the young pigs, with oats and pea-soup. With this soup and dairy-wash, where proper attention is bestowed, young pigs may, he conceives, be weaned and reared in the winter season even with profit and success. The pea-soup is an admirable article when given in this intention; it is prepared by boiling six pecks of peas in about ninety gallons of water, till they are well broken down and diffused in the fluid; it is then put into a tub or cistern for use. When dry food is given in combination with this, or of itself, he advises oats, as being much better than any other sort of grain for young pigs, barley not answering nearly so well in this application. Oats coarsely ground have been found very useful for young hogs, both in the form of wash with water, and when made of a somewhat thicker consistence. But in cafes where the fows and pigs can be supported with dairy-wash and roots, as above, there will be a considerable saving made, by avoiding the use of the expensive articles of barley-meal, pea-beef, or bran and pollard. The farmers should however, as cautiously as possible, avoid having recourse to such substances in their circumstainces, as being unprofitable. Indeed Mr. Donaldson remarks, that in the usual mode, the pigs reared by the farmer are fed, for some weeks after they are weaned, on whey or butter-milk, or on bran or barley-meal mixed with water. They are afterwards maintained on other food, as potatoes, carrots, the refuse of the garden, kitchen, scullery, &c. together with such additions as they can pick up in the farm-yard. Sometimes they are sent into the fields at the close of harvest, where they make a comfortable living for several weeks on the gleanings of the crop; at other times, when the farm is situated in the neighbourhood of woods or forests, they are sent thither to pick up the beech-malt and acorns in the fall of the year. And that when they are arrived at a proper age for fattening, they are either put into stalls fitted up for the purpose, or fold to distillers, flarch-makers, dairy-men, or cottagers. And he adds, that swine are sold to the butcher at different ages, and under different names; as pigs, when a few weeks old; as porkers, at the age of five or five months; and as full grown hogs, from eighteen months to two years old. The young pigs are commonly roasted whole; the porkers are used as fresh or pickled pork; and the full-grown hogs are for the most part converted into ham and bacon. The demand for porkers, which for London in particular is very great, and which continues almost throughout the year, is chiefly supplied from the dairy-farms within reach of that metropolis. From the time they are weaned, they are kept constantly on whey, or skimmed or butter-milk, with frequently an addition of peas or beans, or barley-meal. Such good keeping not only makes them increase rapidly in size, but renders them fit for the butcher at an early age, which is a point of some importance. It is also a matter of importance in the management of fows and pigs, to keep them constantly well littered down with clean straw, or some other familiar article, as by this means they are kept perfectly clean and healthy, and at the same time a large quantity of manure will be raised. And it is obvious, that when the practice of cultivating crops of various kinds purposely for the food and support of swine prevails, the fows and store pigs will of course be supported during the winter season, as from the beginning of November to the middle or latter end of May, by the various roots, as above, that have been flored in this intention, in combination with the preferred dairy-wash, and other articles. Besides, it is advised by Mr. Young, that at the latter of the above periods, the whole of the hogs in the yard should be looked over as forted; such as have attained half or more of their growth being drawn and turned upon the clover field, or choy crops, where they should be kept till towards the latter end of September, the fences being kept in perfectly good order, and proper ponds and other places provided for the hogs to drink at. Under this management they are said, he fays, to grow rapidly, the food in general agreeing well with them, and they are then taken up in excellent condition for being fattened. In this system, the material difference from the former mode, he says, in feeding the sufficiently grown hogs from the fows that have pigs, and the weaned pigs and only leaving the latter to be fed with the dairy or other wash, with suitable green food, such as letuces, cabbages, tares, &c. by which a much larger flock of breeding hogs may be kept. The tares and cabbages may be used for the fows that have spring litters, and the letuces for those that have autumn litters. It is observed, that these plants are of great use for fows and pigs, promoting the increas of milk in a great degree; affording great assistance where the dairies are small; and in all cases tending to prevent the consumption of grain, which is of great importance in this age of economy. From the sweet juicy quality of the lettuce the hogs are not only extremely fond of it, but it becomes highly nutritious. In this way, the swine may be well supported and carried forward till the flubbles are cleared, when they may be turned upon them, and thus the whole year be provided for, in these different ways, with the greatest economy and profit.

The Swedish turnip and the seed of the sunflower may also be used in this way, it is said, with great benefit.

Further, it has however been stated by some, that though this system of management be advantageous, that of foiling the hogs in the yards with green food is, notwithstanding the increased expense of it, and the unavoidable waste of a certain portion of the food, highly preferable, on account of the vast store of manure that may fall upon them. It cannot, however, be attempted with propriety, unless the farmer be provided with abundance of some fort or other of materials for the purpose of litter, and substances of the paste or earthy kinds, for the purpose of covering the floors of the hog-yards, in order to absorb and prevent the waste of any portion of the liquid matters that may fall upon them. In this method, clover, chicory, tares, and lucers, are the kinds of food that are most commonly employed; but there are
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others that may be brought to their affinitie when necess
fary, especially on the stronger forts of land, such as beans
eaten green, which afford a large quantity of food in pro
portion to the land they occupy, the whole items being con
sumed; and cabbages may likewise be had recourse to for
the summer, as well as winter food of these animals. Mr.
Young advises, that the yards of the hog-flies should have
gates sufficiently large for bringing in carts loaded with the
different articles of both food, floors, and litter, as well as
for removing the manure that is made in them. In this sys
tem of prudence, instead of a few, there only being kept, as
was usual in combination with the dairy system, great
numbers may be maintained, and a great many young pigs
be raised. But in order to derive the greatest advantage
from it, the above writer thinks it should as much as possible
be so contrived that the fows only pig twice in the year, as
has been mentioned above; as by this means there will
never be a long and expensive feast for rearing pigs before
they are put to the staple food of clover or pota
toes, &c. But this circumstance is much removed by the
provision of crops raised expressly for swine.

Also the use of hay-tea in the flour-feeding of hogs has
been attempted by Mr. Saunders of Stroud, Gloucestersi
shire, with much success. He was led to the use of this
liquid, from considering its effects in weaning of calves. In
his experiments, as stated in the Agricultural Magazine, the
forts of hay made use of were clover, fainfoin, and lucerna;
and he thickened the tea or wash, indifferently, with
either grains, or bran, or pollard, or any kind of meal, or
boiled cabbages, or boiled potatoes (carrots, though ex
cellent, he had none); sometimes adding two or more of
these articles, as his flock of either most enabled him. And
he had the great satisfaction to find, that he made a single
fack of boiled potatoes, when mixed with wash, and with
out any other ingredient, go as far as four or five facks
(though boiled), when he gave them to the pigs alone; and
the expence of the wash, thickened with potatoes, is con
siderably lower than potatoes alone. With the view of
shewing the practicability of prosecuting the plan individ
ually upon a larger scale, he gradually increased his flock
to upwards of four hundred; and in the course of his ex
periments he used nearly fifteen hundred hogheads of the
wash, confomming, when his fock was at its highest, about
five hogheads daily. And incredible as it may appear, he
maintained them, collectively, at the very low rate of one
penny a-head per day; and in excellent foor order, and
many of them fit for the butcher. It deferves particular
attention, he says, that in a week or fortnight after he
commenced his experiments, the pigs, which he had before
been feeding with potatoes alone, improved in their coats,
which, from looking coarse, assumed a gloss, and became
fine and short; a proof sureiy, it is thought, of the great
nutrition of the food, and of its perfectly agreeing with the
pigs. Nor is it, says he, less remarkable, that this voracious
animal, though fed with this food but twice a day (which
he prefers to oftener), would lie down contented for the re
mainder, provided he was well ringed, and had a warm
and dry place to shelter himself under. And this he attributes
to the following causes, beside the nutritive properties of the
wah. He found it beneficial to feed the boiled potatoes in
large cahes (in which he conceives they would be kept above
a twelve month), and when they had remained in them some
time, freed from the water that they were boiled in
(which is considered noxious), they not only went further,
but they generated a spirit; and the wash being also, as he
apprehends, of considerable strength; they dispofed the an
imal to betake himself to rest, from their loporific and in

toxicating qualities; a circumstance evidently conduci
his quicker growth. Nor can an objection be raised, it is
supposed, to this food, when applied to the flesh of the ani
mal. So far from poissfing any pernicious quality, it com
municates, perhaps, a richer and more delicate flavour to
the pork and bacon than they receive when fed after the
common mode; and the butchers and others not only e
agerly purchased his pigs, but commonly remarked that they
rapidly improved when put up to fatten. And hence, says
he, arises another most important consideration. He is con
siderent, he could make one fack of meal, of whatever de
scription, go as far as two facks in the common mode of
fattening. For, by gradually thickening the wash with
meal, it forms, he thinks, the best introduction to the higher
and last stages of fattening, both for pork and bacon: in
deed that method should be followed throughout the pro
cess, using the wash instead of water. The increased quan
tity of a cheap and highly nutritious food, thus admi
tered, will satisfy the voracious habits of this animal, and
yield, he says, the greatest profit; and this alone would
causet an immense annual saving of cere, which would tend
to ensure plenty and cheapness; the grand desiderata in all
experiments. For the price of a commodity, is a
great degree, depends on the relative quantity produced,
and the regular consumption; to lessen the consumption,
therefore, diminishes the demand, and has the same effect
as increasing the supply, which must necessarily cheapen
the article.

He oberserves further, that clover, or fainfoin hay, at
$2.15. 32. per ton, is $2.80. 60. per hundred, and one half
penny per pound; and that twenty pounds of either, well
boiled, will make, with the addition of the incorporating
ingredients, sufficient wah or food to maintain throughout
the day fifty flore pigs, from three months old to an in
definite age upward.

It is remarked that carrots, either raw or boiled, are ex
cellent; and thafe, with oatmeal and grains, would make a
cheap and good addition. And that the hay, when put into
the furnace to boil, should be inclosed in a net, or a bask
et with a lid to it, or in a tin-kettle and cover, filled with large
beads, and the potatoes (or carrots, &c.) should be fleamed
over the hay-tea, whilst gently boiling or simmering. This
may easily be done, by letting to the furnace a vefel, hav
ing a number of holes of the size of a common auger bored
through the bottom of it, so as to allow the steam to pafs
through the potatoes with which the vefel is filled; and
having a little moill clay, or a wet flanne: or cloth put cir
cularly round the bottom, where it rests on the mouth of
the furnace, fo as to secure the vream from escaping: By
this mode of fleaming the potatoes, a considerabie faving
will be made in the article of coal. The potatoes should
not be slightly fleamed or boiled, and not reduced to a pulp,
and whifht hot, should be trod or rammed in cafs for future
ufe. The hay, after boiling, may be dried, and perhaps
offered to flore cattie; or else thrown to the pigs as litter,
or, to add to the dung-heap. The wah should be carefully
given to the pigs in a lukewarm state, and if meal or pollard
be added, it should be thrown into the tub or cooler imme
diately after boiling the wah, and well mixed together;
but fleaming the meal or pollard, and even the grains, might
be done over the fire. The water, where there is a suf
ficient fall, may be led into the furnace, without any trouble
whatever, by means of a leaden pipe; or may be conveyed
into the furnace by a spout from the pump; and the tea
may be drawn off through a cock into a cooler, which
should be placed by the fide of the furnace. To convey
the wah to the pigs, he used an open barrel or hoghead,
suspended
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suspended upon a pair of shafts, with wheels to it, and drawn by a single horse.

But it is added, that in these estimates of the expense of maintaining the pigs, it should be observed, that he has taken no credit for the article of manure; and thus his pigs will make the farmer a present of their dung, as well as pay him a good price for their keep. Fifty strong sows, with a sufficient quantity of lean hogs (which is frequently ploughed into the land), or carpenters' shavings and sawdust, or virgin earth, or sand, especially sea-sand (where obtainable), laid down in the yard, will make, he says, in the course of the year, from two to three hundred waggon-loads of excellent manure: the sea-sand will add false particles to the manure, and check evaporation. And he thinks it necessary to remark, as a most favourable circumstance, that the hay-sea binds the dung of swine, and renders it hard and black, like sheep's dung; and if it does not produce this effect, it must affinely be either bad in quality, or not properly boiled, or not rendered sufficiently strong; all which particulars should be most carefully attended to; and the state of the dung is an admirable guide to go by. The hay should always be of an excellent quality; and that which heated best, and contains most of the succulent juices, should have the preference. Bad hay is certain destruction to the pigs. Clover stands first, next sainfoin, and lastly meadow hay. Indeed, most of his experiments were made, he says, (though not by choice,) with meadow hay.

However, on the former of the above plans of keeping swine, the taint for lean hogs should, Mr. Young observes, annually take place in October, the litter of April being then dispofed of as sows, and those of August kept till the fall period in the following year, in order to be sold as baconers, when none are fattened on the farm.

And in regard to the expense of keeping all sorts of store-swine, it must obviously vary considerably, according to the convenience of procuring their food, and the excellence of the management that is pursued. In failing years, it has been estimated upon the average at from eighteen to twenty shillings per head a week; and while in pig, from one shilling to eighteen-pence; weaned pigs, at first, from one shilling and sixpence to two shillings and sixpence per head; and afterwards, till they are become fully grown, at from one to two shillings each in the week. Calculations of this sort are, however, liable to much error, or differ greatly under different circumstances.

Fattening.—It may be noticed, in respect to the practice of fattening of hogs, that it is a business usually performed at two different times of the year, as in October, and February or March; the former is, however, the most principal period. In this system, various substances have been recommended; but those most commonly employed are certain substances fit for fatteners, material, with skimmed milk, and dairy or other kinds of whey. For the smaller sorts of fattening hogs, coarsely ground oats mixed with these wheys are excellent. Barley-meal and pollard are likewise frequently made use of for the purpose, with much success. The meals of peas and beans, when given in sufficient proportions for the purpose of fattening, are apt to heat them too much, and produce a difficulty of breathing; the first and second, or the large or full-grown hogs, pea-meal, or peas unground, are probably the best material that can be made use of. A portion of bean-meal, or whole beans, may likewise be given occasionally with advantage, as both these articles contain a much larger proportion of nutritious matter in the same bulk, according to Darwin, than any other sort of grain, and are more laiting in their effects on the system, from their undergoing the process of digestion more slowly, per-
founded, since, upon inquiry, it has been found that the hogs fattened at the distilleries fetch the same price, both at the bacon merchants and Victualling-office, as any other.

Into some parts of the county of Essex a practice has recently found its way, which was first tried, it is believed, by Mr. Pattison, of Maldon, of fattening larger hogs in separate stalls, so constructed that the animal can, at his pleasure, conveniently rise up and lay down, but cannot turn round. It is said that they will thrive in this manner faster than in any other way: they are certainly fed by these means more cleanly, as they cannot get at dirt or filth of any kind; the stalls they are in are paved upon an inclined plane from the head to the tail of the animal, and they are cleaned out every day by means of a hoe and broom. Barley-meal mixed with water is the food; and the above farmer has found the improvement so great, that he will engage that a pig forward in 8f, weighing 70 lbs., shall in twenty-eight days increase in weight to 140 lbs.; the gain of 70 lbs. live weight may be called 45 lbs. dead, which, at 8d. per pound, is 30s., or 72.6d. a week. This is very considerable, and affords sufficient reason for considering that the method is a real improvement. The quietness of these stalls causes them to fatten more quickly, as they have only to eat and sleep. See Pan-Cafe.

These are the principal modes of fattening these useful animals.

It may be observed in regard to the quantity or weight of pork produced by a given quantity of peas, beans, meal, or other materials employed in the fattening of hogs, that it has not been well ascertained, and it is probable that a great deal will depend upon the fixe, breed, and disposition to fatten; but, judging from the value of the animals before and after they have been fattened, it is supposed by Mr. Knight, in a paper in the second volume of Communications to the Board of Agriculture, that a Winchester bulk of the first of the above articles may add about nine or ten pounds to the weight of a good hog of twenty score, or perhaps something more upon a larger, and considerably less upon one of a small size. A hog, he says, when put up to fatten in good condition, and (they should never be put up in the contrary state,) when fat when weigh twenty score, will consume in the proportion of fix or even bushels of peas or other similar materials.

It is said, that the produce of the native Devonshire hog, crossed with the Hampshire or Leicester, will, if fed in the following manner, double its weight in about twelve weeks. Begin with about two-thirds of boiled or steamed potatoes, and one-third of peas and barley ground in equal quantities into meal, well mixed together. The meal must be feaunched and enriched with the meal, as the appetite of the animal may require; and when fat, he will be found to have consumed from fourteen to sixteen bushels of ground peas and barley. This breed, again crossed with the Chinese, will fatten in two-thirds of the time, when it will be found to have nearly, if not quite, doubled its weight also.

It is noticed, that the proportion of fat to lean, or, in other words, of pork to bacon, in the above breeds, may be thus stated. The Devonshire country hog, when well fed, will produce, for one pound of pork, one pound and a quarter of bacon. This, crossed with the Leicester or Hampshire breed, will produce, for three quarters of a pound of pork, one pound of bacon. This cross, again varied with the Chinese, will, in two-thirds of the time, produce, for two-thirds of a pound of pork, one pound of bacon. The breed, therefore, seems to have much influence in this business.

And in respect to the method of giving the different ma-
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terials that are employed in the fatteniny of swine, there are different opinions entertained; some contending that they should be used as much as possible in a solid form, wafis, as drink, being occasionally given; while others prefer the contrary method, as the most beneficial: as, in the latter mode, there will be less time taken up by the hogs in feeding, and of course more left for them to sleep and rest in, as well as more economy in the food and labour of giving it. It is probably the most advisable. Mr. Young supposes the most profitable method of converting corn of any kind into food for hogs, is to grind it into meal, and mix this with water in cisterns, in the proportion of five bushels of meal to one hundred gallons of water, stirring it well several times a day for three weeks in cold weather, or for a fortnight in warmer weas, by which it will have fermented well, and become acid; till which time it is not ready to give. This mixture must always be stirred immediately before feeding, and two or three cisterns should be kept for fermenting in succession, that no necessity may occur of giving it not duly prepared. The difference in profit between feeding in this manner, and giving the grain whole, or only ground, is so great, that whoever tries it once, will, not he, thinks, be apt to change it for the common methods. He further states, that pea-foup is an excellent food for hogs, and may, though he has not sufficiently compared them, equal the above, especially if given in winter, milk-warm. It is, however, well observed, that wherever food is prepared by heat, the expenses of fuel and labour are a great drawback on the profits of the farmer. It should, therefore, be well considered, before it is undertaken. But in whatever way the food may be given, great care must be taken that the hogs have a full allowance at sufficiently short intervals, to keep them constantly in a state of rest; as it is on this principle that they become fat in an expeditious manner. It is indeed frequently observed, in fattening hogs, that they pay better for their keep in the latter part of their fattening than in the former, which probably arises, in some measure, from their not being fed in a sufficiently full manner, or with sufficient frequency in the beginning, so as to keep them in a state of perfect quietude in the flies.

And with regard to the length of time that is necessary in fattening these animals, it varies much according to the state in which they are put up, their fixe, and the difference in their dispositions to fatten; but it is in general from five or six weeks to two or three months, while this process is going on. It is likewise of great importance to keep the hogs clean, dry, and warm, by having them frequently well watered down, the advantage of warm flies, with warm food in cold weather, has been found to be very great in promoting the object of the feeder.

Further, in all cafes, it is the best practice to have the pigs castrated while young, as the male pigs may be gelled at about three weeks old without danger, and the female ones be cut or spayed when a month old; though, in the latter cafe, the operation is frequently performed at a much later period. The fows, when not wanted for the purpose of breeding, may also be spayed. This business is mostly done by persons who are in a flourishing practice of it, and requires experience and care. See Spaying.

It may be stated, that there is a constant necessity to keep all sorts of swine constantly well ringed, in order that they may rest quietly in the flies, and of course thrive in a more perfect manner. This has also been effected by cutting away the cartilage of the nose, in which there is no danger.

On the whole, in the management of hogs, much loss seems to have arisen from the supposition that they can only be kept with profit, in so far as they may consume the ma-
towards that would otherwise be wasted on the farm. There cannot, however, be any doubt, that swine will pay for their keep, as well as any other sort of live-flock whatever, where a judicious system of cultivating crops purposely for them is pursued. This has indeed been fully flown by the various statements that have been made on the subject by different writers.

The author of the Treatise on Cattle has well observed, that it is not improbable that the reputation of Westphalia, for the excellence of its cured pork, is derived from an high antiquity; that the superior delicacy and luxurious flavour of young milk-fed pork is acknowledged, although such a commodity is not to be obtained in every part of the country. And he adds, that pork, of all other flesh meat, is best adapted to curing and preservation with salt, and has the further merit of never cloying the appetite; for it appears that men will subsist longer upon that diet, without desire of change, than upon any other flesh. In various parts of the country the labourers, and even the farmers themselves, very rarely taste, or desire to taste, any other.

It is doubtless, from its solidity, the most economical and the most nutritious food. But it must not be forgotten, that the best is taken out of the trough, and there to be attributed to the superior food which they require; and that pork or bacon will always be sold and good, in exact proportion to the solidity and goodness of the articles on which the animals have been fed. For although graze, hay, roots, or oil-cake, will fatten a sheep or an ox perhaps to the maximum point of goodness, nothing hitherto discovered will do the same with a swine, but milk, corn, or pulse. When fattened with all other sorts of materials, the flesh is loofe, flabby, and of very inferior flavour and quality.

It may be noticed, that in different districts there are different modes of curing the flesh of swine, according to the intention for which it is wanted. In the county of Kent, when cured as bacon, it is the practice to singe off the hairs, by making a straw-fire round the hog, an operation which is termed "sawing." The skin, in this process, should be kept perfectly free from dirt of all sorts. When the fitches are cut out, they should be rubbed effectually with a mixture of common salt and saltpetre, and afterwards laid in a trough, where they are to continue three weeks or a month, according to their size, keeping them frequently turned; and then laid out upon a clothe or board, and covered by a flack fire, which will take up an equal portion of time with the farmer; after which they are to be hanged up, or thrown upon a rack, there to remain till wanted. But in curing bacon on the continent, it is most the custom to have closets contrived in the chimneys, for the purpose of drying and smoking them by means of wood-fires, which is said to be more proper for the purpose. And a more usual mode of curing this sort of meat is of salting it down for pickled pork, which is far more profitable than bacon.

In this method, after the hog is cleaned of the hair, and the head taken off, together with the legs and hands, and the necks, loins, and all the lean bones cut out, which will amount to nearly two-thirds of the whole hog, the remaining part, which is the fat or prime pork, is to be cut into pieces of the size proportioned to the circumference of the faits-tub, and every piece rubbed upon each side and on every part with common salt, having some beaten saltpetre sprinkled on each. The bottom of the tub should also be covered with salt, and when the pork is sufficiently powdered, the pieces laid in, with the wind upwards, and every one pressed down with all the strength that can be used, and Wedged in so close as to leave no apparent chasms. Over this layer is to be spread a covering of salt, with a very slight sprinkling of saltpetre, as too much makes it hard. In about a month or six weeks, the brine will begin to rise, and in a short time afterwards, cover the whole surface of the tub; but if, from a defect in the salt, it should fail to dissolve into brine within that period, it will be necessary to make a quantity of brine, and pour over the pork; for unless the whole be covered with brine, it will not keep well. In adding the brine, care should be taken not to disturb the pieces of pork, as that often does much mischief to the meat.

But in the county of Westmoreland, where the curing of hams has been long practised with much success, this method is for them to be at first rubbed very hard, generally with bay-falts; by some they are covered clove up; by others they are left on a stone-bench, to allow the brine to run off. At the end of five days they are again rubbed as hard as they were at first, with salt of the same form, mixed with rather more than an ounce of saltpetre to a liter. Having lain about a week, either on a stone-bench, or a hogheads amongst the brine, they are hung up by some in the chimney amidst the smoke, whether of peats or coal; by others, in places where smoke never reaches them. If not, a fold is thrown over the hoghead, to keep off the weather becomes warm. They are then packed in hogheads with straw, or oatmeal feeds, and sent to the place of sale. It has been found by experiment, as stated in the survey of that district, that hams lose 20 per cent. of their weight in the curing, which fully demonstrates the want of and economy of confining them without this form of preparation.

Bacon is said to be best cured in Yorksithire, and the best cut up in Wiltshire; but it is well managed in many districts.

Further, swine are subject to many disorders, not of which will be found under their proper heads. Where the parts behind the ears, as is often the case in some forts of them, crack and become sore in hot weather, they should be thickened with a little fatunine ointment; and where the udders of the cows take on hard glandular swellings, as sometimes the case, the use of camphorated fatunine waters or ointments may be employed with benefit, care being taken to have the parts clean wiped before the pigs are admitted to suck. And in such cases, half a dram of calomel may be given every second or third night, for two or three times, by which a favourable change may be induced.

Upon the whole, the hog, from the excellence of its flesh, its prolific nature, and its quick fattening properties, may be considered as one of the most profitable and advantageous of our domestic animals; and which might probably be reared and fattened in many situations, in which it is yet but little regarded by the farmer.

SWINE'S CRATER. See CRATER.

SWINE-CAFE, the name of a fort of wooden building for containing and fattening swine, in some places. See SWINE, CAFE, and SWINE.

SWINE-COUNT, a term provincially applied to a hogsty in many places, as in most of the northern districts of the kingdom. It signifies a fort of hovel of this kind. See HOG, Sty, and PIGEONS.

SWINE-CREW, is also a provincial term used for a hogsty. SWINE-HERD, a term applied to a keeper of swine.

SWINE-OUT, Piles, or Piles, in Agriculture, a particular kind of out, which the are cultivated for the use of pigs in some places, as in some parts of Cornwall. It is the same as or ares a nipt at botanists. By the writer of the correct account of the agriculture of the above district, the cultur
of it is said to be confined to the western parts of the county; and that it is generally the farewell crop, in the bad husbandry of that tract, to such pieces of ground as have been completely exhausted of vegetable food by preceding crops of potatoes, wheat, and common oats. The plant is flated to grow something like the common oat, but that the stem or straw is much finer, being almost as good as hay for fodder; the grain is small, being only about the size of the shelled common oat, but that it weighs as heavy as wheat by the bushel; that the grain is excellent for the feeding of pigs and poultry.

In the former of which applications, one gallon of it, mixed with twenty of potatoes, forms a rich very fattening mela. It should be ground, and be well mixed and incorporated with the potatoes. It was, however, noticed, that in some of the little howels and cottages in the tract for this grain, in the above county, they stirred the whole or un-ground grain over the top of the potatoes, in preparing them; the flour from which it swell much, when it is mixed with the potatoes, and the swine devour it with avidity.

In using it for poultry, they mostly consume it in its natural state, without being in any way reduced.

In many of the other districts, it is probably scarcely known at all that there is such a grain anywhere in cultivation. It has been chiefly grown in black, moorly, mossy soils; and the tillage, culture, and harvesting of it is much the same as for oats.

How far it can be grown in this intention, and for fodder, with advantage, remains yet probably to be proved by further and more correct trials.

Swine-Pipes, in Ornithology, a name used in many parts of England for the red-wing.

Swine-Pow. See Varicella, and Chicken-Pow.

Swine-Stone, or Stink-Stone, in Mineralogy, a name given to those kinds of lime-flour which emit a fetid odour when rubbed, resembling that of naphtha combined with sulphuretted hydrogen. Several kinds of lime-flour possess this property; the most important is the black, or the common black marble, sometimes called Lucullite, from Lucullus, the Roman consul, by whom it was much admired. The colour is a greyish-black; it is hard, and receives a high polish, but is sometimes spotted with shells, and other organic remains, nearly white, as well as that, as well as more distinctly visible, when the marble has been exposed to a warm temperature, as is the cafe in chimney-pieces. When this kind of marble is dissolved in sulphuric acid, a smell of sulphuretted hydrogen is emitted. It contains a portion of oxyd of carbon, to which it probably owes its colour, and also a minute portion of sulphur, and some alkali.

Black marble forms one of the upper bed of mountain lime-flour in Derbyshire, and one of the middle beds of mountain lime-flour in the mountains of Craven, in Yorkshire, adjoining Westmoreland. The latter is extremely black, and takes a most beautiful polish. It was first discovered in that district by Mr. Francis Webster, turass of Kendal, by whom it is extensively used for chimney-pieces, and other articles. The dark-brown lime-flour in the vicinity of Bristol is another variety of (wine-flour, forming an upper stratum in the mountain lime-flour.

Some beds of the magnesian lime-flour near Sunderland are swine-flour; these occur above the coal formation. In other characters, swine-flour resembles common lime-flour and marble. See Marble and Lime-stone.

Swine-Thistle, in Agriculture, the same as the cow-thistle. See Thistle.

Swineford, in Geography, a small poât-town of the county of Mayo, Ireland; 103 miles N.W. by W. from Dublin, and about 14 N.E. from Cashel.

Swinehead, or Swinburne, an small market-town in the wapentake of Kirton, Holland division of the county of Lincoln, England, is situated 7 miles W. from Bothen, and 113 miles N. from London. A degree of importance has attached to this town, from its having been the first retting-place of King John, after he left the whole of his baggage, and narrowly escaped with his life, when crossing the marshes, in his military progress from Lynn to Shrewsbury, the castle of which latter place was then in his possession. He left Swinehead on horseback, but being taken ill with a dysentery, was moved on a litter to Shrewsbury, and thence to his castle at Newark, where he died on the following day. Matthew Paris and other historians ascribe the king's death to a fever, brought on by vexation, and heightened by improvidently eating peaches and drinking new cyder. But an author, who lived about a century after the event, asserts that the king died in consumptions of poisons, administered by a monk of a religious houle which then existed at Swinehead. This afflication is combated, and the circumstance fully discussed, in a letter from Mr. Pegge to the Society of Antiquaries, published in Archaeologia, vol. iv. This religious houle was an abbey of Cistercian monks, founded in the year 1154, by Robert Greelie. The site was granted, 5 Edward VI., to Edward lord Clinton. Of the abbey buildings no vestiges now remain; but a manse was erected out of the ruins by one of the family of Lockton. In the parish church, a spacious edifice, with a lofty chancel, is a monument of Sir John Lockton, who died in 1610. Swinehead was rated, in the population return of the year 1811, to contain 273 houses, occupied by 1561 persons. A weekly market is held on Thursdays, and two fairs annually.

In the adjacent parish of Surfleet is Creley-Hall, the property of Mr. Heron, a descendant of Sir John Heron, privy councillor to Henry VII., whose mother was here once fumpoumously entertained by Sir John. The state-bed on which the lay is described by Stukeley to be made of curiously embossed oak: it is preserved in a farmer's houle in the neighbourhood. Creley-Hall was rebuilt in 1695, by Sir Henry Heron, knight of the Bath. At Surfleet is one of the greatest heronries in the kingdom, though it has been considerably reduced, and that, as well as the trees of the wood of the birds do to the land.—Beauty of England and Wales, vol. ix. Lincolnshire, by J. Britton, F.S.A.

Swinemunde. See Swinemund.

Swinesund, a town of Norway, in the province of Aggerhuus; 5 miles S.W. of Frederichshall.

Swing, To, in Sea Language, is to turn round the anchors, or moorings, at the change of the wind or tide. It is usually expressed of a ship, either when she is moored by the head, or riding at single anchor.

Swine-Bridge, or Swineford Bridge, a kind of moveable bridge on canals, much used for occupation bridges.

Swing or Leaf-Drug, in Agriculture, a name applied to that sort of tool of this kind, which is formed in somethings of a leaf-manner, by which it is enabled to give way in the middle part, and to be folded up into half the size; by which means it not only works better on rounded ridges, but takes up much less room when out of use.

There is a patent tool of this sort which is constructed in a good deal in the same manner, but in which the tines or teeth are often placed much too upright, in the sense, which, in the opinion of many farmers, has an inconceivable fault; as they are said to work better, and more easily, where they are set in a somewhat leaning-forward direc-
tion, thereby cutting the land over in a more effectual manner.

This sort of tool, when made use of on five-bout lands or ridges, or three and other number of bouts of small dimensions, should constantly be formed so as to suit pretty exactly to the fixes of them, and in such a manner, as that they may clear both the outside furrows at once, in which the team or moving power may go.

This sort of tool is often found of very great utility on the stronger kinds of land, which have laid some length of time in the ploughed state, before they are intended to be prepared for the seed, and which have not had deep folded upon them. Some of the lighter sorts of these tools also, in some fields, answer well to be run over the ground after the feed has been sown.

SWING-GEN: See GATE.

SWING-PLough. See PLough.

SWING-Tail Hog, a name applied to a particular breed of these animals. See SWINE.

SWING, or Waggon, is the bar softened across the fore guide, to which the traces of the horeses are fastened.

SWING-Wheel, in a royal pendulum, that wheel which drives the pendulum. In a watch, or balance-clock, it is called the crown-wheel.

SWINGING, in Geography, a river of Germany, which runs by Stade, and discharges itself into the Elbe, a little below.

SWINGING was prescribed by ancient physicians, as good exercisf in some cafes. See AGITATION.

SWING, or ISIN, in Geography, a town of Istria; 6 miles N.W. of Mitterburg.

SWINGLE, in the Wire-work: in England, the wooden spoke which is fixed to the barrel that draws the wire, and which, by its being forced back by the cog of the wheel, is the occasion of the force with which the barrel is pulled.

SWINOLE, in Rural Economy, a term signifying a crank; also an implement used for beating rough flax, which is sometimes called a towpin.

SWINOLE-HAND, another term applied to the same implement; also to the hand which uses it.

SWINOLE-Tree, a term signifying a plaster-bar whippis, or whistle-tree. See WHIPPLE-Tree.

SWINOLE-Trees, Indented, in Agriculture, that sort of contrivance to which the wood of an indented or toothed iron rack, of about a foot or a foot and a half in length, firmly fixed on, in, or about the middle of the strong wooden or bar part of it, in which, by the removal of the loop of the draught chain into the different indents of the rack, the draught is capable of being nicely equalized and adjusted according to the particular circumstances of the team or working-power. The bar is formed from a strong piece of tough ash-wood, made the thickest and broadest in the middle, and so as to gradually taper a little, in both these respects, to each of the ends, on which loops are mostly fastened for receiving the hooks of the traces. The indented part is made of a strip of thin iron about an inch in breadth, doubled up together at every tooth, and nailed fast upon the fore-part of nearly the middle of the swingle-tree, on which the draught loop moves in each direction.

This sort of swingle-tree is much used in the Furness part of the north of Lancashire, as a very convenient contrivance for equalizing the draught of horses, in ploughing with the teams double. Thus, when two animals walking in the furrow are yoked to that end of the swingle-tree which is towards it, and only one upon the land-side draws by the other end; if the moveable middle loop, which is connected with the plough by a chain, be placed in the indented part of the swingle-tree, at one-third of the length of it from the end towards the furrow; the land-horse, taking two-thirds of the implement or bar, will perform one-third of the labour, with as much ease and convenience as his companions.

In practice, however, as the performance of the fore-ends horse is commonly less than either of those behind, probably in consequence of being at a greater distance from the post or centre of draught; so the land-horse usually draws works with less length than two-thirds of the swingle on his side of the loop, which has been found to be necessary by actual experience.

And when the draught consists of two or four hors, the sliding loop is placed in the first notch from the side, which is equidistant from the ends of the implement, by, or contrivance of this kind.

This sort of swingle-tree is consequently of much importance in all cafes where the teams are employed double, but more especially where the number of animals is not equal. They should be had by all farmers who have teams working double.

SWINGING. See BRAKE.

SWINHOLM, in Geography, one of the small Shetland islands.

SWINHULT, a town of Sweden, in Est Gothland; 40 miles S. of Linkoping.

SWINNA, one of the smaller Orkney islands, being about 20 inhabitants, near the S.W. coast of South Ronaldshay.

SWINOE, one of the Faroe islands, in the North sea.

SWINOGROD, a town of Russian Poland, in the palatinate of Braclaw; 70 miles E. of Braclaw.

SWINOY, a small island in the Caspian sea, about 11 miles from the W. coast. N. lat. 59° 52'.

SWINTON, JOHN, in Biography, a learned antiquary, was born at Baxton, Cheshire, in 1703, and entered as a scholar at Wadham college, Oxford, in 1719, and admitted to priest's orders in 1727. In the following year he was elected fellow of his college, and soon after accepted the office of chaplain to the English factory at Leghorn. While abroad, he visited Venice, Vienna, and Feiburg, and became a member of the academy "Dei Apulfus" at Florence, and of the "Estrafcan Academy" of Cortona; and in 1730 he was elected fellow of the Royal Society. On his return he settled at Oxford, and was appointed chaplain to the county gaol, and keeper of the archives to the university. He married, but had no family, and died in 1777, at the age of 74. He was a recluse scholar, and subject, like others of that description, to absence of mind. His erudition was profound and recondite. His dissertations on antiquities, coins, and inscriptions, Estrafcan, Phoenician, and Persian, were numerous, and most of them may be found in the Philosophical Transactions. He was also a writer in the Universal History, and composed in that work the account of the Carthagins and other ancient African nations, the Turks, Tartars, Moguls, Indians, and Chinsefs, and dissertations on the peopling of America, and on the independency of the Arabs. Gen. Biog.

SWIRSEN, in Geography, a town of Farther Finland; 7 miles E.S.E. of Polnow.

SWIT, in Natural History, a name given by the people of the Philippine islands to a very small bird of the humming-bird kind, frequent in that part of the world. It is beautifully coloured, and lives on the honey of flowers.
SWITAWKA, in Geography, a town of Moravia, in the circle of Olmutz; 38 miles W. of Olmutz.
SWITHA, one of the smaller Orkney islands. N. lat. 58° 41'. W. long. 2° 58'.
SWITOCZ, a town of Lithuania; 65 miles S.E. of Mink.
SWITZERLAND, SWITZERLAND, Helvetic Republic, or Helvetica, a country of Europe, comprehending under this denomination, not only the 13 cantons of the League, but other states or districts allied to the Swiss, or subject to them; extending in length from E. to W. about 190 or 200 miles, and in breadth from N. to S. about 130 or 140 miles. It contains about 14,960 or 15,000 square miles, and about 1,800,000 inhabitants. It is bounded on the N. by Alsace and Swabia, on the E. by Tyrol and Trent, on the S. by the Venetian territories, the Milanese, Savoy, and the lake of Geneva, and on the W. by Burgundy and Franche Comté. Its boundaries are rather arbitrary than natural; though on the W., mount Jura separates it from France, and on the S. the Pennine Alps form a kind of partial barrier from Italy.

History.—This country lies between 55° 50' and 60° 50' of E. long., and between 43° 50' and 47° 43' of N. lat. The provinces to which the appellation of Switzerland is now applied, were in ancient times variously denominating. The Romans regarded them as a part of Gaul; and they were principally poissified by the Helvetii on the W. and the Rhetti on the E., the chief city of the Helvetians being Aventicum, now Avenche. The origin of the Helvetii is uncertain. Some have supposed that they were of Celtic extraction; others, with greater probability, deduce their origin from a Gothic race, and regard them as an ancient colony of Germans. (See HELVETIA.) The Rhetti are said to have been a Tufcan colony; but this hypothesis is liable to objections. (See RHETIA.) Before the commencement of the Christian era, the territories of the Helvetii were divided into four provinces, whose capitals were Zurich, Zug, Orbe, and Avanches or Avenches. These cantons formed one state, in which Caesar found 12 towns and 400 villages. When Helvetia was reduced to the form of a Roman province, it lost its name; a part of it being united to Sequania, and the remainder to Rhettia superior. After the fall of the Roman empire, this country may be considered, in a general view, as poissified by the Alemanni on the E., who made an irruption in the beginning of the fourth century, and are suppos'd by some authors to have extirpated the ancient Helvetians. They also held Swabia and Alsace. This country on the W. may be regarded as a part of Burgundia; the inhabitants being styled "Burgundi trans Juraenses," because, with regard to France, they were situated on the other side of the mountains of Jura. When the western part of Switzerland, as far as the river Reus, was subjugated by the Franks, they annexed that portion to Burgundy. The Grisons on the E. were subject to Theodoric, and other kings of Italy. The conversion of the country to Christianity, by the Irish monks Columbanus, Gallus, and others, took place in the beginning of the seventh century. Alemannia was invaded by the Huns in the year 909, and subsequent contests with these barbarians lasted till about the middle of that century. The abbey of St. Gall was ravaged by the Huns; but they were afterwards defeated by Conrad, king of Burgundy, about the year 918. About the year 939, the provinces which now constitute Switzerland began to be regarded as a part of the empire of Germany. Divided among several lords, secular and spiritual, the inheritance of the former at length, in the course of about two centuries, chiefly centered in the house of Hapsburg, afterwards the celebrated family of Austria; and on its emancipation in the beginning of the fourteenth century, first appeared the modern denomination of Switzerland, either derived from the canton of Schweiz, distinguished in that revolution, or from the general name of Schweitzer, given by the Austrians to the Alpine people. For the sake of precision, modern writers restrict the orthography of Schweiz and Schweizer to the canton; while the general appellation for the people is the Swiss, and for the country, Switzerland or Swissland. While the greater part of the country was rent in pieces by faction and civil discord, the three cantons of Uri, Switzer, and Unterwalden, environed by ridges of mountains, lakes, and rivers, remained in profound tranquility. When, indeed, the greater part of Helvetia was subject to the German empire, the inhabitants of these cantons had long enjoyed very considerable privileges; particularly the right of being governed by their own magistrates; and though the clergy and many of the nobles had seizes and subjectias in these respective territories, the bulk of the people formed several communities almost independent. During the twelfth century, various disputes between the three cantons and the emperors united them more firmly, and they were accustomd every ten years, to renew formally their alliance. Such was their situation at the death of Frederic II. in 1250. From this period, or soon afterwards, commenced the interregnum in the empire; during that time of anarchy and confusion, the nobles and bishops endeavouring to extend their power and to encroach upon the privileges of the people, Uri, Schweiz, and Unterwalden, threw themselves under the protection of Rhodolph of Hapsburg, who, in 1273, being chosen emperor, terminated the interregnum. Rhodolph received a small revenue from these cantons, and appointed a governor, who had cognizance in all criminal causes, and expressly confirmed the rights and privileges of the people. Soon after his ascension to the imperial throne, Rhodolph listened to the ambitious schemes of his son Albert, who was desirous of forming Helvetia into a duchy. For this purpose the emperor purchased the domains of several abbeys and other considerable seizes in Switzerland, as well as in the canton of Schweiz as in the neighbouring territories. The three cantons, alarmed at this increase of power, obtained a confirmation of their privileges, which, upon the death of Rhodolph, was renewed by his successor Adolphus of Nassau. But when Albert was elected emperor, he refused to ratify their rights, and this refusal led to consequences, detailed under the article SCHWEITZ, which terminated in the famous revolution of January 13, 1538, and laid the foundation of the Helvetic confederacy. This confederacy became afterwards very formidable by the accession of the other ten cantons, and by the additional strength of its numerous allies; and hence it has remarkably happened, that Switzerland is the only country which, on the one side, has confined the limits of the German empire, and on the other has, until a very late period, set bounds to the French monarchy. The accession of Zurich, Berne, Lucern, Zug, and Glarus, gave strength and solidity to the union; and a century and a half elapsed before a new member was admitted. At length, in 1501, Fribourgh and Soleure, being, after much difficulty, received into the league, the eight ancient cantons, on that occasion, entered into a covenant, called the "Convention of Stans," by which the articles of union and mutual protection were finally settled. No change was effected by the subsequent reception of the three remaining cantons, Basle, Schaffhausen, and Appenzel; as they subscribed to the same terms which Fribourgh and Soleure had accepted.

The code of public law between the combined republics of
of Switzerland, is founded upon the treaty of Sempach in 1353; upon the conclusion of Stans; and upon the treaty of peace concluded in 1712 at Aarau, between the Protestant and Catholic cantons. From these several treaties it appears, that the Helvetian union is a perpetual defensive alliance between the 13 independent contracting powers, to protect each other by their united forces against all foreign enemies. Another essential object of the league is to preserve general peace and good order: for which purpose it is covenanted, that all public disquisitions shall be finally settled between the contending parties in an amicable manner, and with this view particular judges and arbiters are appointed, with full power to decide of all the cantons from being current within their own territories; may impose taxes and duties; and, in short, perform every other act of absolute sovereigntiy. The public affairs of the Helvetian body and their allies, are discussed and determined in the several diets: and these are, 1. General diets, or general assemblies of the 13 cantons and of their allies; and 2. Particular diets, as diets of the eight ancient cantons; of the Protestant cantons, with the deputies of the Protetants of Glarum and Appenzel, of the towns of St. Gallen, Bienne, and Mulhausen, called the "evangelical conferences;" 4th of the Roman Catholic cantons, with the deputes of the bishops of Glarum and Appenzel, of the abbots of St. Gallen, and of the republic of the Vallaiss, called the "golden alliance;" and of the diets of particular cantons, which, beside being members of the general confederacy, have distinct and separate treaties with each other. The ordinary meetings of the general diet are held once a year, and continue sitting one month; the extraordinary assemblies are summoned upon particular occasions. The canton of Zurich appoints the time and place of meeting, and the deputy of Zurich presides; unless the diet of the territory of any other canton shall, at their request, cause the deputy of that canton to preside. Each canton sends as many deputies as it thinks proper. The last diet of "Free Switzerland" assembled at Aarau in January, 1798, and all the deputies, that of Basle excepted, which withdrew from the confederacy, took an oath to defend the Helvetic constitution to the last extremity; but this solemn appeal to heaven in defence of their liberties produced, as the sequel proved, no substantial effect. Their confederacy was dissolved by the French invasion A.D. 1798.

The whole republic is composed of 13 cantons, 13 incorporated territories, and 21 dependent lordships. The cantons are Zurich, Berne, Lucern, Uri, Schwyz, Unterwalden, Zug, Glarus, Basal or Basle, Friburg, Solothurn, Soleure, Schaffhausen, and Appenzel, which see respectively. The number of inhabitants in the 13 cantons is said not to exceed 975,000.

The canton may be divided into "affiliated" and "confederated" states; of the latter are the abbot and town of St. Gallen, Bienne, and Mulhausen; and of the latter are the Grisons, the republic of the Vallaiss, Geneva, Neuchatel, and the bishop of Basle. The following landvogtei, bailiwicks, districts, and towns, belong, as joint property, to certain cantons. As subjects of the cantons, we may enumerate Thunraug, Rheinhal, containing Rheinneck, the capital, the market towns of Alfelden and Berne, and several villages; Sargans; Gafier or Gold, a mountainous territory, bounded on the W. by Gluma, on the N. by Utznach and Topgenburg, on the E. and S. by Topgenburg and Sargans, lying in N. lat. 46° 10', watered by the Linth, and now belonging to the cantons of Schwyz and Gluma, the inhabitants of which principally subsist by spinning, and the principal town of which is Sargans (which see); Utznach; Rapplreichweil; Baden; the territory of the Free Amts, called the county of Rohr, or Rori; and Waggenthal, bounded on the S. by Baden and on the S. by Stuttgart, on the W. by Lucerne and Berne, lying in 47° 20' N. lat., 40 miles long and 5 broad, containing 20,000 inhabitants, the upper division of which belongs to the 8 cantons, and the lower to Berne, Zurich, and Glars. The Italian territories are those which lie beyond mount St. Gothard, in Italy, bounded by the canton of Uri, the Grisons, and the district of Milan; the three first belong to Schweiz, Uri, and Unterwalden; the other four to the cantons in general, Appenzel excepted. These are Bellinzona, or Bellinz, 5 leagues long and 2 broad, in N. lat. 46° 10', containing 5,000 inhabitants; Pontebre, or Polle, 4 leagues long and 2 broad, watered by the Tsen and the Blegno; Val di Blegno, or Val Bressa, a fertile valley, environed by lofty mountains, and watered by the Blegno, all which contain 5,000 inhabitants; Lugano, 5 leagues long and 2 broad, containing 5,000 inhabitants; Maymatt, or Val Maggia, about 28 miles long, bounded by high mountains, watered by the river Maggia, or Maym, yielding fine wines and noble manufactures; Aranzona, or Aranzo, a fertile and extensive country, containing 30,000 inhabitants; the small district between the lakes of Como and Lugano, very fertile, and containing 15,000 inhabitants. The allies of Switzerland are Gerfaw, or Gerfau; the Benedictine abbey of St. Gall, and its territories lying in Brifan, Swiss, and Austria, and containing 91,800 inhabitants; the county of Topgenburg; the city of St. Gall, and the territory, containing 8300 inhabitants, who carry on flourishing linen manufactures, and a considerable trade; the ancient towns of Biel or Bienne, having about 5500 inhabitants; the three units of the territory of Biel or Bienne and the counties of the country, composed of three bodies, called Buns or leagues, viz. the Grey or Upper League, the League of God's House, and the league of the 10 juridictions, all of which were united A.D. 1471, and now form one republic, consisting of 135 parishes, and 98,000 inhabitants. The vassals of the Grisons occupy a valley upwards of 30 miles from W. to E., watered by the Adda, at the foot of the Alp Alp, containing three counties, and 87,000 inhabitants. This valley comprehends the county of Chur, (which see,) the western part of the valley, 20 miles long, and 5 broad; and the barony of Heldenstein, in N. lat. 46° 50', confining a semicircular plain, about five miles long, and scarcely one broad, with a population not exceeding 400 persons. For an account of the Vallaiss, Neuchatel, Valais, Geneva, and the Glacier, see the respective articles.

Constitution and Government.—Under the former head we have already given some account of the government of Switzerland. The cantons of Berne, Zurich, Lucern, and Friburg were aristocratical; those of Uri, Schwyz, Unterwalden, Zug, Glarus and Appenzel, were democratic. The aristocracies were composed of a great council and senate; the latter, in some cantons, enjoying exclusive power.
SWITZERLAND.

Authority, and in others acting under the control of the great or supreme council, that assembled at stated times, and superintended the administration of public affairs. In the democracies the supreme power was wielded in the people at large, who, in several cantons, assembled annually for the purposes of legislation, and in others to choose their magistrates and councils of regency. Notwithstanding this great variety in their forms of government, an almost uninterrupted tranquility reigned in those small independent republics. The constitution of the 13 cantons was abolished by the French in 1798, and by the constitution of the 29th of May, 1801, Switzerland was divided into 17 departments. In February, 1803, a new government was presented to the 19 cantons into which Switzerland was divided. According to the constitution now established, the legislative power in every canton was vested in a grand council, and the executive power entrusted to a little council or senate. The number of members in each council, their times of assembling, their jurisdictions, and other circumstances, are specified. Thirteen of the cantons send 13 deputies, and five of the most populous cantons send 12 deputies, to form a general assembly, called a diet, to meet successively at Friburg, Berne, Soleure, Bale, Zurich, and Lucern. Contributions levied in proportion to the population of each canton. What may be the future constitution of Switzerland, since the expulsion of Bonaparte from France, and the restoration of the Bourbon government, time must develop. If the Swiss should emancipate their country, their chief object should be protection against the power of France, to which no measure will be more conducive than a strict alliance with Austria.

Revenue and Military Force.—Before the late revolution, the military force was reckoned at 20,000; the Swiss regiments in foreign service were computed at 25. By the constitution of 1803, the national force of 15,203 men was apportioned in various proportions to the 19 cantons. The revenue was formerly computed at somewhat more than a million sterling, arising from moderate taxation, tolls, national domains, and foreign subsidies. The cantons of Berne and Zurich were considered as opulent, while in others the resources hardly equaled the expenditure.

Population and Manners.—The population of this interesting country has been generally computed at 2,000,000, or at least 1,000,000; it is usually reckoned at 1,200,000. The number of families is about 300,000. The population probably exceeded 1½ million. The inhabitants are divided into two classes; the first composed of citizens and gentlemen, who reside either in the towns or in the country, the latter of whom enjoy the privileges of citizenship in the capital of their respective cantons; the second class consists of the inhabitants of the villages and country, some of whom live by the culture of their fields and vineyards, and by the profits arising from their cattle, and the others by manufactures and trade. From the Swiss cantons every appearance of pomp and luxury is excluded, and the strictest economy is practised. Equality is preferred by a custom that is prevalent; which is, that, of dividing estates among all the children, male and female, with this exception, that a father may bequeath one-third of his property to any one of his sons, as he pleases, so that the one is raised too much above the level of the rest of the community. A spirit of independence and freedom, tempered by decency and good order, pervades all ranks of these people. Jealous of their privileges, and tenacious of their liberty, they are enamoured of their country, the mild government and sublime scenery of which are often discovered to them its indefitible attractions. They are honest, sober, industrious, brave, and remarkable for their fidelity. Religious in principle, they are addicted neither to superstition nor fanatical enthusiasm. Their customs and diversions are of the warlike kind. Plays, gaming, dancing, &c. are discouraged. The higher orders, in their dress and general mode of life, imitate the Germans and the French; but the drest and manners of the inferior classes are plain and simple, not subject to the laws of fashion. Their houses, except in some less fashionable valleys, are chiefly furnished with furniture, and ready to be furnished with the least expense. They indulge in up delicacy of fare, their ordinary food being the fruit of their labour and the product of the soil. The original simplicity of the pastoral life is everywhere preferred; none seem to be discontented; none are miserably poor, and scarcely any beggars are to be seen. Under a mild government all live at ease, excepting in some populous cantons, where liberty is abridged, and justice partially administered.

Language and Literature.—The language of Switzerland is a dialect of the German, but the French is much diffused, and often employed by the better class of people in the southern parts, bordering on Italy, the common tongue is the Italian. Among the Grisons the Romansch prevails. In Vailais there is a particular dialect. The French is the language of the Pays de Vaud; and the language called the Vaudois is confined to the valleys of Piedmont. Since the reformation of letters and the reformation of religion, Switzerland has given birth to many persons distinguished by their literary attainments and performances. Among these are the names of Boller, denominated the father of German literature; John and Jacob Bernouilli, eminent mathematicians; Bonnet, a natural historian; Bullinger, a theologian; Buxtorf, celebrated for his rabbinical learning; Euler, a famous mathematician; Fussi, a classical scholar; J. Gofner, an antiquary and philosopher; Conrad Gofner, a philosopher and mathematician; Pliny, a mathematician and architect; J. Mallet, a distinguished scholar; H. Mallet, an antiquary; Necker, a statesman and financier; Otherwalt, a theologian; Paracelsus, an alchymist; Rouxseau, a well-known writer; Saffi, a physician and writer; Saffi, a writer and philosopher; Fussi, a natural historian; the Turcati, theologians; Wettstein, a learned critic and divine; Zimmermann, a physician; and Zuingle, a zealous reformer, &c. &c. Education has been an object of attention in Switzerland, so that even the peasants are well informed. Besides the universities of Geneva and Baze, the Calvinists more especially have public schools and academies at Zurich, Berne and Lausanne, and they have also literary societies in different parts of the country.

Religion.—The reformation was introduced into Switzerland by Zuingle, who differed in some speculative points from Luther and Calvin. The Roman Catholic system is established in the cantons of Lucerne, Uri, Schweitz, Unterwalden, Zug, Friburg, Solothurn, part of Glarus, and the interior part of Appenzell. The Calvinistic or reformed cantons are, Zurich, Berne, Bazz, Schaffhausen, great part of Glarus, and the exterior communities of Appenzell. The lordship of Haldenstein, and the town of Neufhadt, are Lutheran. Every town and state has its own particular constitution for the management of its churches, but the academies, schools, and other ecclesiastical affairs, but all live in mutual amity, without invading the rights and privileges of one another.
SWITZERLAND.

Manufactures and Commerce.—The staple commodities of Switzerland are flax and cotton, which are manufactured in various ways; and a considerable quantity of leather is tanned. The country produces excellent butter and cheese in great abundance. Although Switzerland has many navigable rivers and lakes, commerce has been too much neglected. Among the articles of export are horseth, cattle, butter, cheese, raw hides, silk stuffs, linens, watches, distilled liquors, &c. The imports are corn, flax, hemp, flax, cotton, wine, salt, and a variety of manufactured goods.

Climate, Soil, and Products.—The climate is deferently celebrated as fabulous and delightful. The best of the southern parts, though sufficient to mature the grape, is attempered by the cold gales from the Alps and glaciers. When the sun defends beyond mount Jura, in a summer's evening, the alpine summits long reflect the ruddy splendour, and the lakes for near an hour assume the appearance of burnished gold. The winter, however, is in some parts extremely severe, and the fummer heat in the deep valleys is sometimes oppressive. The face of the country is generally mountainous, and though Thurgau, and part of the cantons of Basle, Berne, Zürich, Schaffhausen, and Fribourg, are the most level districts, yet these present eminences which may be called mountains, as they are from 2000 to 3000 feet above the level of the sea. No country exhibits a diversified an appearance as Switzerland; the vast chain of Alps, with ®ne precipices, extensive regions of perpetual snow, and glaciers that re semble seas of ice, are contrasted by the vineyard, and cultivated field, the richly wooded brow, and the verdant and tranquil vale, with its happy cottages and crystal streams. Although in such a country sculpture cannot be expected to flourish, yet the industry of the inhabitants affords a supply of goods sufficient for domestic consumption. Barley is cultivated even to the edge of the glaciers; oats in regions a little warmer; rye in those that are much sheltered; and spelt in the warmest parts. But the produce being uncertain, granaries are provided for furnishing a supply in case of any deficiency. The country, however, being best adapted for pasturage, the Swiss chiefly depend upon their cattle, and much land is laid out for winter forage, which would otherwise be productive of corn. As calculated in considerable quantity, and tobacco has been lately introduced. The Solow, or those of the Pays de Vaud, the cantons of Berne and Schaffhausen, the Valais, and the Valtellin, which latter also produces afrom. The country affords abundance of fruits, apples, pears, plums, cherries, and siberes; with mulberries, peaches, figs, pomegranates, lemons, and other products of a warmer climate, in those districts which border upon Italy. But pasturage forms the chief province of the Swiss farmer; and the frequent irrigation of the meadows is practised in order to increase the produce of hay. In the beginning of summer the cattle are conducted to the accessible parts of the Alps by cow-herds, who are called "Sennen" in the language of the country, and who either account to the proprietor for the produce, or agree for a certain sum. These herds also support many swine, with the butter-milk and other refuse.

The rivers of Switzerland are numerous; and among the most sublime scenes of the country may be classed the fountains of the Rhine and the Rhone, two of the most important streams in Europe. If we estimate their length of course through the Swiss dominions, the Rhine is the most considerable; and this is followed by the Aar, the Reuss, the Limmatt, the Rhone, and the Thur, which serve respectively. The lakes are also numerous and interesting: the most considerable are those of Constance on the N.E. and Geneva on the S.W. Only a part of the lake Maggiori, or that of Locarno, is subject to Switzerland; but the lake of Lugano forms an extensive body of water in that region. The lakes of Neufchatel and Zurich are each about 15 miles long, and about four broad. That of Lucern is about 12 in length, and its greatest breadth not exceeding three. Near to these are the lakes of Thun and Brienz; of Joux and Roula, on the French confines; the lakes of Morat and Bienne, of Sempach, Zug, Wallenstadt, and others of inferior note.

The mountains of Switzerland are the most celebrated in Europe, and are supposed inferior in height to none, except those of South America, which derive their advantage from standing on an elevated plain. In a general point of view, the Alps extend, in a kind of circular form, from the gulf of Genoa, through Switzerland, which contains their centre and highest parts, and close in the Carnic Alps, on the north of the Adriatic sea. (See Alps.) Of forests there does not seem to be any remembrance in Switzerland; and wood is so scarce, as well as turf, that the dung of cows and sheep is often used for culinary fires. Switzerland has a southern climate, and its elevated situation, may be considered, with regard to its botany, as an epitome of all Europe.

The horseth of Switzerland are esteemed for vigour, and spirit, and its cattle often attain great size. Among the animals peculiar to the Alps are the ibex, bouquet, goat of the rocks, the chamois, and the marmot. Among Alpine birds we may enumerate the vulture, called also the golden or bearded vulture, the red-legged crow, and turke caeruleus. The lakes of Switzerland have few peculiar fish; but to the mineralogy of Switzerland, we may observe the softhearted, or down particles of gold, as the Rhine, the Emmat, the Aar, the Reuss, the Adda, and the Goldbach. It has also mines of silver, and also copper and lead; the chief mines are those of iron, in the district of Sargans. The canton of Berne has valuable quarries of rock-salt; and it is said that coal and sulphur are not unknown. But the great stores of minerals are in Feldman, and the southern sides of the Alps. Rock-crysalt is thought to be the chief export of Switzerland, pieces having been found that weigh from seven to eight hundred-weight. The most remarkable parts of the Alps are the satin marble, and good slates are not uncommon. The country is said to consist of granite and porphyry. Among the Alps are also found serpentines, felsates, albitos, and amethysts, with jaspers, agates, and various petrifactions. Near Chiasso is a quarry of grey lapis olari, which has been brought into pots of various dimensions, and which will stand the fiercest fire. Among the mineralogical curiosities may be named the adularia, or glasy felspar, on the mountains of Adula; and the tremolite, thus called from the valley of Tremola near St. Gothard. The most remarkable mineral waters are those of Leuk. In the country of Sargans are the singular warm baths of Fabara, or Pfersch; to the south-east are the sulphureous baths of Almert. Coxe. Playfair. Pinkerton.

In the year 1798, when the several cantons of Switzerland were united under the appellation of the Helvetic Republic or Confederacy, an uniform mode of keeping accounts was adopted, viz. in franken or francs of 10 batzen; each franc being divided into 10 rappen. The franc was equal to 14 francs of the new money of France. The money coined from 1798 to 1803 bore the flamen of the "Helvetic Republic," and consisted of gold pieces of 32 and 16 francs, silver pieces of 40 and 90 batzen, or 4 and 3 francs, and base silver pieces of 10 and 5 batzen. In 1805 Switzerland became
became again a federative republic; each canton was allowed the right of coinage; but the standard of the pieces was to be uniform, and the coins of each canton were to be current throughout the whole country. These consist of silver pieces of 1, 2, and 4 francs; and base silver pieces of 5, 1, and ½ batzen and 1 rappen.

The coinage of all the cantons has been abolished by a law of the following: the franc is to contain 127½ Swiss grains (or 104½ English grains) of fine silver, and the price of the mark of fine silver is to be 36½ francs.

The pieces of 1 franc are to be at the rate of 32½ to the mark; and the pieces of 2 and 4 francs in proportion: the silver is to be 10 deniers 19½ grains fine, with an allowance of 1 grain for remedy in the fineness. The remedy of weight in the francs is 16 grains per mark; in the 2 frank pieces, 12 grains; and in the 4 frank pieces, 8 grains per mark. The ½ batzen pieces are to be at the rate of 74 to the mark, 8 deniers fine, the remedy 4th of a piece per mark, and 1½ grain in the half batzen, 120 half batzen, 36 rappen, to weigh a mark; the batzen are to contain 1 part of silver in 6½ the half batzen, 3 parts in 32; and the rappen, 1 part in 24. No law has been made for gold coins, except that each of the cantons may with to have them, must regulate the coinage in such a manner, that the franc may contain 8½ Swiss grains of fine gold.

The franc, according to the above law of the diet, is worth 14½d. sterl., or 17 sterl. = 16 francs 4 batzen 7 rappen, in new Swiss money. Kelly's Cambi.

SCHWITZ. See Schwytz.

SWIVELS. A kind of rings made to turn round in a staple, or other ring. These are used when a ship lies at her moorings in harbour, to which the cables or bridle goes are bent, that the ships may swing round to the tide; also in tendrers for cattle, that they may turn round without warping the tender.

SWIVEL-Cannon. A small piece of artillery, belonging to a ship of war, which carries a shot of half a pound, and is fixed in a socket on the top of the ship's side, aero, or bow, and also in her tops. The trunnions of this piece are contained in a socket of iron crotch, whose lower end terminates in a cylindrical pivot reeling in the socket, so as to support the weight of the cannon. The socket is bored in a strong piece of oak, reinforced with iron hoops, in order to enable it to sustain the recoil. By means of this frame, which is called the swivel, and an iron handle on its cap-cabell, the gun may be directed by the hand to any object. It is, therefore, very necessary in the tops, particularly when loaded with musket balls, to fire down on the upper decks of the adversary in action.

SWIVEL-Hook. A hook that turns in the end of an iron block bar, &c. for the ready taking the turns out of a tackle.

SWIVEL-Headed Churn-Staff. In Rural Economy, that kind of staff of this sort which turns upon a swivel. See STAFF-Churn.

SVOJANOW, in Geography, a town of Bohemia, in the circle of Chuden; 9 miles S.E. of Politzka.

SWOONING. See Swoon.

SWORD, an offensive weapon, worn at the side, serving either to prick, or cut, or both. Its parts are the blade, guard, hand or grasp, and pommel; to which may be added, the bow, scabbard, hook, and sheath. The matters of defence divide the sword into the upper, middle, and lower part; or the front, middle, and foible or small and weak part.

Anciently, there was a kind of two-handed swords called spades, which were to be managed with both hands; and which in those days they accustomed themselves to brandish so nimblly, as to cover the whole body with them.

The favages of Mexico, when first visited by the Spaniards, had a kind of wooden swords, which would do as much execution as ours. In Spain, swords are only allowed of such a length, determined by authority. The ancient names gave names to their swords; Augo, was that of Charlemagne; Durandal that of Orlando, &c.

Before the discovery of metals, swords were fashioned probably, like those of the Mexican favages already mentioned, of some heavy wood, hardened by fire; next to their brazen, or rather copper swords were introduced, of which fort many have been found in Ireland. (See Archaeologia, vol. iii. p. 555.) And after the art of tempering steel was understood and practised, they were made of this metal. In early ages, swords were of such value as to be kept in temples and sanctuaries, and to be specially bequeathed in the wills of princes and great warriors; and in the days of chivalry they were distinguished by proper names, descriptive of their supposed qualities, or alluding to their destructive powers; a method of distinction borrowed from the Persians and Arabsians, and practised by Mahomet. Swords were also of various forms, and used with one or with both hands, for thrusting or cutting, or for both purposes. The swords used by the Roman legiary troops were very short and strong, the blade rarely exceeding nineteen inches in length, two-edged, and made for either stabbing or cutting. The swords of the Britons, called spathe, were large, long, and heavy; as were also those of the Saxons. The Norman swords were also long and heavy.

The sword was carried in a belt of buff or other leather, girded round the body, or thrown over the right shoulder; these shoulder-belts were called baddirck. Among modern swords we read of a bracemart or short sword, the fucado or long sword, the elpadon or two-handed sword, the Swiss or balsket-hilted sword, a Spanish sword or toledo, a tuck inclosed in a walking-stick, a poniard, dagger, which seems to have been a constant companion of the sword, at least since the days of Edward L., fabre, and fychtar, to which may be added the fable, a broad sword with only one edge.

SWORD, Broade, sometimes called the back-sword, has only one edge, and is balte-handled.

Sword-Bearer, an officer in the city of London, who attends the lord mayor at his going abroad, and to carry the sword before him, as the emblem of justice.

It is observed by an ancient writer of armoury, that the bearer must carry it upright, the hilts being hidden under his bulk, and the blade directly up the middle of his breast, and between the sword-bearer’s brows. The sword was likewise carried before the principal officers of boroughs, and other corporate towns, to represent the state and princely office of the king, as the chief governor. See Sword-Bearer. See Port-Glave.

Sword-Belt. See Belt.

Sword-Blade, Mill for. See Mill.

Sword, Plies of. See Plies and Janus Gladii.

Sword, St. James of the. See James.

Sword-Fish, Xiphias, in Ichthyology, the name of a genus of fish of the order of Apodes.

The characters of this genus, according to Linnaeus, are, that the membrane of the gills has eight bones, and the point or extremity of the nose, snout, or upper jaw of the fish, is shaped like a sword, and the body taper and without scales. There is only one species, viz. the Xiphias
SYA

According to the Artedian system of ichthyology, the characters of this genus of fish are these: the branchial membrane on each side contains about eight bones; the snout is extended into a very long and depressed point, imitating the figure of a sword, and of a bony substance; the body is oblong and roundish; the back-fin is small, and is very low in the middle; there are no belly-fins at all. The air-bladder in this fish is remarkably long, and the anus very near the tail.

The sword-fish is so remarkable for the shape of its snout, which is extended in form of a sword, that it has been called by all nations by a name expressive of that character. Its common name, *spatius*, is from the Greek, *spatios*, a sword, and it is called *gladius* in Latin, and in English the sword-fish.

It grows to a very considerable size, so as sometimes to weigh an hundred pounds. It is of a long and rounded body, large near the head, and tapering by degrees toward the tail; its skin is considerably rough, its back black, and its belly of a silverly white; its mouth is of a moderate size, and has no teeth; its four points, cut into the figure of a sword in the upper jaw, the under is much shorter, and terminates in a very sharp point; it has one only fin on the back, running almost the whole length of it; its tail is very remarkably forked; it has only one pair of fins at the gills, having none on the belly. It is common in the Mediterranean, and some other seas, and is esteemed by many a very delicate fish for the table. The manner of fishing for it is the same at this time that the old writers have described it to be in theirs, by the harping-iron. Willughby.

The ancient manner of taking this fish is particularly described by Strabo (lib. i. p. 16), and agrees exactly with that practised by the现代人. A man ascends one of the cliffs that overhangs the sea; as soon as he spies the fish, he gives notice of the course it takes. Another that is stationed in a boat, climbs up the masts, and on seeing the sword-fish, directs the rowers towards it: as soon as he thinks they are got within reach, he descends, and taking a spear in his hand, strikes it into the fish, which, after wavering itself with its agitation, is seized and drawn into the boat. It is much esteemed by the Sicilians, who buy it eagerly for about 6 L. per pound, at its first coming into season. The seafarers fetch from May till August. This fish is said to be very voracious, and a very great enemy to the tunny, which, according to Belon, are as much terrified by it as sheep are at the sight of a wolf. Ovid. Halieut. 97. Pennant.

**Sword-Grass**, or *Sweet Ryes*, in Botany. See ACORUS.

**Sword-Hand**, in the *Manege*. See HAND.

**Sword-Shape Leaves**, in Botany, *Folius ensiformia*. See LEAF and ENSETE.

**SWORDS**, in Geography, a poft-town of the county of Dublin, Ireland, not far from the sea, and on the great northern road. There is in this place one of the most perfect of the ancient round towers, which is 73 feet high, and 50 or 60 feet distant from the church. Here are also some other ruins. Previous to the union, Swords was one of the boroughs called potwallaping. It is seven miles N. from Dublin.

SYA, a town of Sweden, in Wett Gothland; 13 miles S.W. of Linkoping.

SYALCOLE, a town of Bengal; 30 miles N. of Pulcule.

**SYAMA**, a name of the Hindoo goddess Parvati. The name means black, similar to kali, another of her many names. (See KALI and PARVATI.) Syama is also the name of a dog attendant on Yama, the Hindoo king of hell.

**SYANG**, in Geography, a small island in the Pacific ocean. N. lat. 0° 25'. E. long. 130° 50'.

**SYANPOUR**, a town of Hindooftan, in Oude; 113 miles S. of Canoge.

**SYASKUTAN**, one of the Kurile or Kurilofk islands, about 50 versts from another island, called At-Amazut, between which the current is very rapid. This island, which is 5000 feet long, and 5000 feet broad, has a large port. Upon it are two high rocky mountains; one of which stands in the northern half, on the north-east shore, extends ridgewise, and has formerly burnt; the other, being a huge rock, is on the promontory near the north-west side, and from the peninsula to the sea-shore, on both sides, consists of nothing but rock and crumbling stone.

**SYBARIS**, in Ancient Geography, a town of Libya, on the mouth of a small river of the same name, in the Gulf of Tarentum, at the point of division between Bruttium and Lucania. The Greek and Latin historians concur in giving that ancient and famous city a Greek foundation. It bore successively the appellations of Sybaris, Thurium, and Copia; all which terms, according to their etymologies, denote abundance. According to Strabo, Sybaris was founded, or at least re-established, by the Achaeans. According to Justin, it was founded by Philoctetus. Whatever might be its origin, it became so considerable, that if we give credit to ancient authors, it gave law to four nations and twenty-five cities, and could muster 30,000 fighting men. The walls of the capital included a space of five miles and a half, and its suburbs, extended near seven miles along the Crathis. The natural richness of the adjacent soil encouraged agriculture, and furnished abundance of articles for commerce; and the convenience of its situation between two considerable rivers, the Sybaris and the Crathis, favoured a great exportation. From these sources wealth flowed copiously into the state, and with it brought such luxury and degeneracy of manners, as have excited astonishment and indignation of all ancient writers; so much that the term "Sybarite" became proverbial to denote a man devoted to pleasure. So enfeebling were the effects of this luxury, that 70,000 inhabitants, says, in- fact, to destroy all their grandeur and prosperity; 147 years B.C. the Crotoniates, amounting to 100,000, under their famous commander, the athlete Milo, encountered them at Siagre, and totally defeated them. Breaking down the dams that kept out the Crathis, they let the furious stream into the town, which soon overturned and swept away every edifice of use or ornament. The inhabitants were massacred without mercy; and the few that escaped the slaughter, and attempted to reform their state, were cut to pieces by a colony of Athenians, who afterwards founded the new city of Thurium, on or near the same spot, which, in process of time, became subject to the Lucanians. Diodorus, differing from Strabo, says, that 50 years after its destruction, it was repeopled by the Tar- tarians, who were afterwards expelled by the Crotoniates; and that it was at that time that the Athenians came hither with ten vessels. After the destruction of Sybaris, Thurium became a considerable state, under the discipline of Car- ronies, who died a martyr to the spirit of his own laws. Having fixed the pains of death upon any citizen that should enter the senate-house armed, and being reminded that his hurry he had brought a sword with him into the senate-room, he immediately plunged it into his own breast, and seals his decree with his own blood. Thurium flourished for a long time under the dominion of Rome; till falling into decay,
decay, it was judged expedient to send a colony thither, under the confulate of T. Sempronius Longus and Scipio Africanus, in the year of Rome 559. After this event, it assumed the name of Copia. The coins of Sybaris are amongst the most ancient known; being of the fort called "incus," i.e. convex on one side, and concave on the other. They bear a bull, which some have thought to be an emblem of the subdued river, long their friend and purveyor, but in the end an instrument of their destruction. The great works undertaken to drive back its waters are probably, it is said, expressed by the head of the animal being turned back on its shoulder. The spot on which this city stood, noted to a proverb in ancient history for the luxury and effeminacy of its inhabitants, is now merely indicated by a few degraded fragments of aqueducts and tombs.

Sybaris, a fountain of the Peloponnesus, in Achaia Propria, near the town of Bura, according to Strabo—Allo, a town of Asia, in the Colchide, which was the residence of the king of the country.

SYBER, or SYBORG, in Geography, a town of Germany, in the county of Mark; at which place stood anciently the strong citadel of the Saxons, called "Sigeburg," or "Syburg," at the confluence of the Ruhr and Lenne, which was wholly destroyed in the year 1287; 3 miles S.W. of Schwiert.

SYBILHEAD, a cape on the west coast of Ireland, in the county of Kerry; 8 miles W.N.W. of Dingle. N. lat. 53° 10'. W. long. 10° 18'.

SYBOTA, in Ancient Geography, a port of Epirus, upon the coast of Almene, between the mouth of the river Meanias and the city of Torona, according to Ptolemy—Allo, the name of an island on the coast of Epirus.

SYCABIS, in Ornithology, a name by which some authors have called the atricapilla, or black-cap, a small bird well known in England.

SYCAMINOS, a word used by some for the mulberry fruit, and by some for the tree.

SYCAMINOS, in Ancient Geography. See CAJPHA.

SYCAMINOS is also a town which Phileteutus places on the confines of Egypt and Ethiopia. Ptolemy calls it "Hieria Sicaminos!" and places it on the E. bank of the Nile, and S. of the lesser cataract.

SYCAMORE, a species of ficus, or fig-tree. See FICUS.

The sycamore grows to a large size; the wood is soft, white, and valued by the turners: this tree thrives better than most other trees near the sea, and is frequently cultivated to screen plantations of other kinds from the spray. It is a tree of the timber kind, which throws out a wide spreading head. Its leaves are vine-shaped, and on their first appearance are of a pleasant green; but their beauty is soon defaced by the perforations of insects, which leaven its value for ornamental purposes. And it is a fort of a tree which is easily increased, as in the autumn, when the keys are ripe, they may be gathered, and in a few days after from, about an inch and a half deep, in beds of common mould. In the spring the plants will appear, and make a shoot about a foot and a half by the autumn following, if the ground of the nursery be tolerably good, and they are kept clean from weeds. In the spring after they come up, they should be planted in the nursery in rows two feet and a half asunder, and their distance in the rows must be one foot and a half. Here they may remain till they are big enough to plant out finally, with no further trouble than taking off unsightly side-branches, and such as have a tendency to make the tree forked, except digging between the rows, which must always be done every winter.

The sycamore is likewise a tree that grows very well on moat of fords of soils, and of course may be usefully cultivated in many cafes by the farmer. It is observed by Mr. Young, in the 7th volume of his "Annals of Agriculture," to be the only tree which grows erect, and refits the wind and spray of the sea; but the beech has lately been found to answer well in such situations.

Sycamore-Tree, a name improperly given by us to the Acer majus. See MAPLE.

Sycamore-Moth, in Natural History, the name of a peculiarly large and beautiful moth, or night-butterfly, so called from its caterpillar feeding on the leaves of the sycamore. This caterpillar is remarkably large, very often growing to three inches and a half long, and three quarters of an inch in diameter.

These caterpillars being put into a box, each spun itself a strong and firm case, which it fastened to the side of the box, and in it waited the time of its last transformation: in each of these shells there was left a small aperture, by means of which the creature was to get out when in its butterfly state, and the head of this animal was placed exactly against this aperture. In this state it lay all the autumn, winter, and spring, and in the beginning of summer comes out in the shape of a very elegant moth. The wings, when expanded, measure more than five inches, and each has an eye, like that on the peacock's tail, near the extremity. The horns are of the feathered kind, and are very large and elegant; and the body and origins of the wings are covered with very long hairs. Med. Acad. Par. 1692.

SYCE, in Ancient Geography, an island situated on the coast of Ionia, according to Pliny.

SYCHEUM, a maritime town of Arabia Felix.

SYCION, a word used by some authors to express a decoction of dried figs.

SYCITES, the fig-stone, a name given by some authorities to such natural nodules of flint or pebbles, as happen to approach to a fig in shape.

SYCTES, or SYCTES, a term used by the ancients to express a wind verged with figs.

SYCOMA, or SYCOSIS, from σκομαί, a fig, an excrecence like a fig.

SYCOMANTIA, σκομαντια, in Antiquity, a species of divination performed with fig-leaves; for which see Potter, Archaeol. Græc. lib. ii. cap. 18. tom. i. p. 353.

SYCOPHANT, σκοπαθειν, formed from σκοπειν, a fig, and θαυμα, I discover, a Greek term originally used at Athens, for persons who made it their business to inform against those who filled figs, to the owners, or against them who, contrary to the law, which prohibited the exportation of figs, praefaced the thing, and deceived the officers, the inspectors of the ports, &c.

At length the term became used, in the general, for all informers, tale-bearers, parasites, flatterers, &c. especially those in the courts of princes: and at last, for liar, impostor, &c.

SYCOPHANTIC PLANTS. See Parasites.

SYCOSIS, in Medicine, σκομαντια, from σκομαί, a fig, an eruption of inflamed and hardish tubercles, affecting principally the beard or the face, and forming a granulated prominent ulceration, which somewhat resembles the soft infide pulp of a fig.

This cutaneous malady was mentioned by Celsus as occurring at Rome. "Et etiam ulcus, quod ad faciem similitudinem σκοματικας ad Graecas nominatur, quia caro in eo excrecit." (Celsus, De Med. lib. vi. cap. 3.) The later Greek
Greek writers are not all agreed in their use of the term; but Paul of Aegina properly describes it as an eruption on the face of "round, red, somewhat hard, painful, and ulcerating tubercles." (Lib. iii. cap. 22.) And Aëtius mentions the disease as "one of the affections of the chin, which," he justly observes, "differs from Acne in the nature of the humour which it discharges, and in its greater tendency to ulceration." (Tetrabib. ii. Serm. 4. cap. 14.) Dr. Willan intended to include it in the eighth order of his classification of cutaneous diseases, in which place it is described by Dr. Bateman in his "Practical Synopsis" of that arrangement, as assuming two forms, one when it occurs on the chin, ycosis mentis, and another, when it occupies the hairy scalp, S. capillitii. See that work, p. 297.

In the first species, the tubercles begin to arise on the under lip, or on the prominent part of the chin, in an irregular but somewhat circular cluster; and these are followed by succedaneous clusters, spreading along the course of the jaw up to the ears, and even under the jaw towards the neck, as far as the beard grows. The tubercles are red and smooth, and elevated, some of them nearly attaining the flesh. Their progress is a steady one, often occupying the space of three or four weeks; but gradually a thick matter oozes out, matting together the hairs of the beard, and rendering shaving impracticable. This rugged and scabby condition of the eruption, intermixed with the matted and encrustcd beard, not only occasions a considerable degree of deformity, but becomes very troublesome, from the violent itching which accompanies it. Its duration is various; but it is commonly slow and tedious, and will sometimes discharge again after being healed.

This form of ycosis necessarily affects principally men; but women are not altogether exempt from it, though they suffer but little from it, when it occurs in them.

The second species, ycosis capillitii, appears chiefly about the margin of the hairy scalp, and the tubercles are arranged in clusters of an irregularly circular form. They are softer and more pointed than those of the chin; and they all pass into suppuration in the course of eight or ten days, becoming confluent, and producing an elevated, unequal ulcerated surface, which often appears granulated, so as to exhibit some resemblance to the internal pulp of a fig. The ulceration, as Celsus states, is generally humud; for there is a considerable discharge of a thick ichorous fluid, which emits an unpleasant rancid smell. "Ex duro exiguum quiddam et glutinosum exit: ex humido plus, et mali odorire."--Celsus, De Med. lib. vi. cap. 5.

The ycosis, under its former species, may be mistaken for the violent kinds of acne, which is situated chiefly upon the face; it if it is not observed that the disease is limited to the part occupied by the beard; that the tubercles are softer and more numerous than in acne, and arranged in clusters; and that they tend to produce ulceration. When it is seated on the scalp, as in the second species, the ycosis may be confounded with the porrigo, or putrefactions and ulcers, called favè. But an attentive observer will mark the tuberculated, hard, and elevated base of the suppuring tumours in the disease in question, which does not occur in the soft scabbing putrefactions of porrigo. The latter, too, is a contagious disease; the former not.

The cure of the ycosis is sometimes slow, but not in general difficult. When the tubercles are numerous, inflamed, and confluent, and especially when the suppuration is either beginning or considerably advanced, the most speedy benefit is derived from the application of poultices at night, of bread and milk, linseed powder, or other simple ingredients. In the less severe forms, warm ablations or fomentations may be substituted. When the inflammatory symptoms are reduced, and in cases where they are from the first moderate, the healing process is much promoted, and the discharge moderated and restrained by the application of the ointment of nitrate of mercury, diluted with three or four parts of simple cerate, or by the ointment of the white precipitate, united with an equal portion of zinc or fumigerum nitrate. At the same time it is useful to prescribe antimonials, with alternative dozes of mercury, followed by cinchonas, or mercurialis, and the fixed alkanes, especially where there appears to be any affection of the digestive organs, which not unfrequently accompanies this eruption. See Bateman's Practical Synopsis of Cutaneous Diseases, p. 291, 3d edit.

SYCOTA, a word used by some of the ancients to express a sort of food prepared of figs.

SYCOTON, a name given by the ancients to the liver of a pig fed with figs. This was esteemed a very elegant dish among the old Greeks.

SYCTA, in Ancient Geography, a town of Aisa, is the interior of the territory of the Tereus. Procopius.

SYCURRUM, a town of Syria, in Magnesia, situated at the foot of mount Osia. Livy.

SYCUSSA, an island situated in the vicinity of liss. Pliny.

SYDABAD, in Geography, a town of Hindostan, in the fubah of Agra; 14 miles N. of Agra.---Allo, a town of Hindostan; 50 miles W. of Benares.

SYDAPOUR, a town of Bengal; 28 miles S.E. of Boglipour.---Allo, a town of Hindostan, 44 miles N. of Nellore.

SYDBY, a town of Sweden, in East Bothnia; 10 miles S. of Christianstad.

SYDENHAM, Thomas, in Biography, a physician of extraordinary genius, was born at Winford-Eagle, in Devonshire, about the year 1624. He was the son of a gentleman of independent fortune, and was sent to Oxford in 1640, where he was admitted a commener of Magdalen Hall. But on the occupation of that city as a garrison for Charles L in the civil war, Sydenham, whole connections were with the parliamentary party, his eldest brother being a colonel in their service, quitted it, and went to London. Here, as he informs us himself, an accidental illness of his brother brought him into an acquaintance with Dr. Thomas Coke, an eminent physician who had been called in, and who, finding him altogether undecided as to the choice of his profession, and perceiving him to be a young man of great acuteness, persuaded him to commence the study of medicine, on his return to Oxford. Sydenham adopted this suggestion, and returned to Magdalen Hall, for the purpose of carrying it into execution, as soon as that city was delivered up to the parliament; and in April, 1666, he took the degree of bachelor of physic. About this time, through the interest of a near relation with the parliamentary party, he obtained a fellowship of All Souls College, in the place of a member ejected for his political opinions. After pursuing his studies a few years, he quitted Oxford without any farther degree, and subsequently obtained that of doctor of physic at Cambridge, and settled in the practice of his profession in Westminster.

The extensive practice which he is said to have enjoyed from 1660 to 1670, is perhaps only to be accounted for by the greater success which his superiority of skill in the discrimination and treatment of diseases would necessarily command, and which, from the novelty of his plans, would become more readily a matter of notoriety; for, from this period, namely, after the restoration, his opinions and prac-
SYDENHAM.

tical connections must have been on the wrong side. He appears to have met with opposition, too, on the part of the college; since he never was admitted to the rank of a fellow, and was only made a licentiate at a late period of his life. It is certain, indeed, that he experienced no small share of the enmity and calumny which is usually excited by innovation; yet he appears, from his dedications to Drs. Mapleton, Brady, Faman, Cole, &c. to have possessed some intimate and valuable friends in the profession; and he seems to have conducted himself towards all without any of that arrogance which too often accompanies originality of talent.

An anecdote has been related, on the authority of Sir Richard Blackmore, in proof of Sydenham's contempt for all medical writings. He is said to have replied to an inquiry respecting the best books to be read to qualify a man for practice, "read Don Quixote." Sir Hans Sloane, however, who affirms that he never knew a man of brighter natural parts, believed this to be a joke. It is certain, indeed, that Sydenham paid little attention to the prevalent medical doctrines which were taught in the principal schools of Europe, and were adopted by most of the practitioners of his time. His sagacity led him to a more philosophical mode of acquiring pathological knowledge. He tells us that, on commencing practice, he was immediately convinced, that the only means of acquiring a correct knowledge of his art, was by a diligent and laborious study of the phenomena of disease, by giving up his whole mind to the investigation of the changes and progress of symptoms, from which the true and natural indications of cure would be readily deduced; an opinion which every subsequent year served only to confirm. (See his "Epistola Dedicatoria" to Dr. Mapleton.) He adds, that his friend Mr. Locke (the celebrated writer on the human understanding) approved of this method, and there is a complimentary cantos of Latin verses by that able author, prefixed to his treatise on fevers.

It was to febrile diseases that he first applied this inductive method, and he admits that it was after several years of anxious attention and perplexity that he satisfied himself respecting the proper and successful mode of treating these maladies. In 1666 he published the result of his observations on these fevers, in a work entitled "Methodus curandi Febres, propriis Observationibus superfructi." After he had published, with remarks suggested by subsequent experience, under the new title of "Observations Medica circa Morborum Acutorum Historiam et Curationem," 1670, 1675. In this work, however, as in some of his other writings, we find hypothetical language pretty largely intermixed with found practical observation. He commences with a definition of febrile after the Hippocratic doctrine, viz. that it is "a violent effort of nature, for the benefit of the constitution, to expel a morbid cause." Thus, the plague he deemed a struggle to drive out the contagious matter by means of buboes, perspiration, or various eruptions; and the gout a providential exertion to depurate the blood by expelling its impurities; and according to the degree of violence with which this is effected, and the rapidity with which the critical depuration takes place, the disease, he affirmed, was acute or chronic. Nevertheless, in his practice he seems to have been little influenced by hypotheses; but to have regulated his views by an attentive consideration of the symptoms, and of the juventatis and sedentia; and in this respect he was the author of much practical improvement. In the treatment of the small-pox especially, then a most frequent and fatal epidemic, he was led to adopt a most salutary method of cure, by repressing the eruptive fever, by means of cool air and antiphlogistic remedies, by which the subfebrile eruption and consequent danger were greatly diminished; although this was in opposition not only to the prevailing practice, which confided in forcing the eruption by heat and stimulating medicines, but to the hypothetical doctrine, which he had himself admitted. Subsequent experience has not only fully confirmed the propriety and success of his practice, but has shown the necessity of extending it to other eruptive and febrile diseases. The sagacity and found observation of Sydenham were also particularly manifested in the correct histories of some diseases which he has left. His descriptions of the small-pox, mealect, and gout, have been deemed models of medical history; and his detail of the singular variety of deceptive appearances, which hysteric affluences in females, is a display of extraordinary acuteness. He was extremely attentive also to the varieties which occurred in diseases, especially of the febrile clafs, in different feasons, and which required a corresponding modification of the treatment; and he has pointed out what he terms the epidemic constitution of particular years, by which all the prevailing diseases were in some degree modified.

The other works in which Sydenham promulgated his mode of practice, were "Epistola Relpouforis due; prima, De Morbis Epidemicis ab Anno 1675 ad 1680, ad R. Brady; secunda, De Luís Veneræ Medica et Cura- tione, ad H. Faman," 1680; "Differtatio de Febribus ad G. Cole, De Observationibus superis circa Curationem Variolarum confluentium, necnon de Affectione Hyste- rica," 1682; "Differtatio de Febre putrida Variolis consuetibus supereveniente; et de Mortu Sanguineo, a Calculo Renibus impaèto," 1682; "Tractatus de Podagra et Hy- dropsia," 1683; "Schedula Monitoria de Novæ Febris ingreffe," 1685. On the subject of stone in the kidney and gout, this author had but too much opportunity of acquiring ample information, having been subject to both these maladies for more than thirty years, which impaired his constitution, and ultimately terminated his life. He died in December, 1689, at the age of sixty-five. After his death, a manual of practice, which he had composed for the use of his son, was published by a friend, to whom he had consigned the MS., under the title of "Processus Integri in Morbis fere omnibus Curandis," 1693; which contains a very brief notice of the symptoms of many diseases, both acute and chronic, with some familiar formule.

Sydenham ever maintained the character of a generous and public-spirited man; and has been universally acknowledged the first physician of his age. The numerous editions of his works, indeed, both singly and collectively, in almost all the countries of Europe, the deference paid to his authority, and the commendations bestowed upon him by almost all practical writers since his time, amply prove the solidity of his title to the high reputation attached to his name. The College of Physicians, which admitted him late in life even to the privileges of a licentiate, have subsequently placed his bust in their hall, near that of Harvey. Haller gave his name to the age of medical history, in which experiment and observation began to be substituted for hypothetical doctrines; and Boerhaave, who never mentioned him but with a sort of veneration, thus expressed his praise in a public discourse. "Unum eximum habeo, Thomam Sydenham, Anglie lumen, Artis Phæbum; cujus ego nomen fine honorificæ pretiatione memorare ere- becerem; quenque quoties contemptur, occurrat animo vera Hippocratifæ viri species, de cujus erga Rempublicam Medicine meritia nuncum ita magnificè dicam, quin ejus iod fit suprætura dignitatis." See Eloy. Dict. Hist. de la Mé- dicine.

Gen. Ch. Cal. Periarch inferior, of three, linear-lanceolate, acute, spreading, permanent leaves. Cor. Petals three, roundish, concave, spreading, the length of the calyx. Stam. Filaments three, capillary; anthers oblong. Fg. Germin superior, roundish; style thread-shaped; stigma trifid. Peric. Capsule globular, crowned with the style, of one cell and three valves. Seeds five, globular, flattened, two affixed to each valve, one above the other.


SYNE, or ASSUN, in Geography, a city of Egypt, situated on the east side of the Nile. This town is celebrated for the first attempt to ascertain the measure of the circumference of the earth, by Eratosthenes, a native of Cyrene, who, about the year 276 before Christ, was invited from Athens to Alexandria by Ptolemy Euergetes. Near it, as a small island on the Nile, anciently called Elephanta (Elephantine), is a temple of Cnopus still standing, very little injured; here was likewise a Nilo-meter, but this is not to be discovered. In this town, which was situated under the tropic, according to the report of Strabo, a well was sunk which marked the summer solstice, and the dry season is not known when the style of the sun-dial cast no shade at noon: at that instant the vertical sun darted his rays to the bottom of the well, and his image was reflected on the water. Syene is at present a miserable place, with a small fort, commanded by an aga of the Janizaries: the remains of the ancient town are on an eminence to the south. Columns and pillars of granite, scattered here and there, denote its former glory. There is an ancient building, perhaps the observatory of the ancient Egyptians; 375 miles S. of Cairo. See ASHQUAN.

Juvenal was exiled at Syene, under a pretext of commanding a cohort there.

Pliny says that the name of Syene was also given to a peninsula 1000 paces in circuit, upon the confines of Ethiopia, on the Arabian coast, in which was a Roman garrison. SEE NITE, in Mineralogy. See SINITE.

SYER, in Geography, a river of France, which rises about two leagues to the N. of Thionville, and runs into the Moselle near Waffersbich.

SYESSA, in Ancient Geography, a town of Italy, in Tyrrhenia.

SYFER, in Coinage, a copper coin of Ecbatana. As a money of account, 6 syfer = a silver. See Coin and Money.

SYGAROS, an island situated on the coast of Arabia Felix. Pliny.

SYIA, a small town of the island of Crete, which served as a port to the town of Elyrus.
SYKE, in Rural Economy, a roll or small brook, in a low boggy situation.

SYKES, ARTHUR ASHLEY, D.D., in Biography, a learned and liberal divine of the church of England, was born in London about the year 1684. Educated at St. Paul's school, he was admitted of Bennis College, Cambridge, in 1701. When under-graduate, he composed a copy of Hebrew verses on the death of King William. He took the degree of M.A. in 1708, and engaged as one of the assistans in St. Paul's school. Quitting this situation, he devoted himself to study, and particularly to that of the scriptures; and in 1712-13, he was collated by archbishop Tenison to the vicarship of Godmornham in Kent. In answer to a sermon of Dr. Thomas Brett, he published an examination of that part of it which related to the incapacity of persons not episcopally ordained to administer Christian baptism. Although he took occasion to speak respectfully of Difenters, this circumstance did not prevent his obtaining from the duchess-dowager of Bedford a presentation to the rectory of Dry-Drayton, in Cambridgeshire, on which he resigned his vicarage. In 1715 he published a tract, intitled "The Inocuity of Error averted and vindicated," which served as an argumentative defence of a position advanced by him, "that no hereby is so destructive to religion as a wicked lie; no schism so damnable as a couple of sin, nor the ground of his reasoning was, "that no errors, if involuntary, are or can be punishable." In subsequent editions he animadverted on the objections that had been urged against the doctrine which he advanced. In several of the controversies which took place in the reign of Queen Anne, and on the introduction of the house of Hanover, with regard to the doctrines of passive obedience and non-resistance, the power and danger of the church, and its connection with the state, he took a part, always appearing the decided advocate of Whig principles in the state, and of those called Hoadletian in the church; always allowing himself the ally and defender of such men as Hoadley and Clarke. In a tract, intitled "The external Peace of the Church only attainable by a Zeal for Scripture in its just Latitude, and by mutual Charity; not by a Pretence of Opinion," he argued, "that a latitude of opinion is intended and allowed by the legislature to librifiers, as they are members of the church of England;" which position was proved to be untenable in the "Confessional." In 1718, Mr. Sykes was instituted to the rectory of Rayleigh, in Essex, and resigned his living in Cambridgeshire; and in the same year he was nominated by Dr. Clarke, as rector of St. James's, to be afternoon preacher at King's-court chapel, Golden-square, Sir Isaac Newton confirming the appointment. In 1721 he was nominated by Dr. Clarke to the office of morning preacher at this chapel. In the mean while he published an answer to Mr. Rogers's "Discourse of the visible and invisible Church of Christ;" and a letter addressed to the earl of Nottingham, who, in answer to Whiston's letter to him on the eternity of the Sou and the Holy Ghost, for which his lordship was thanked by the university of Oxford, had advanced some intolerable maxims. In 1721 he published a pamphlet, intitled "The Cafe of Subscription to the XXXIX Articles considered, occasioned by Dr. Waterland's Censure of Arian Subscription," in which he again defended latitudinarian subscription. This controversy produced replies and rejoinders. In 1725, on the recommendation of Dr. Clarke, he was appointed assistant preacher at St. James's. To Collins's "Discourse on the Grounds and Reasons of the Christian Religion," published in 1744, Sykes published a reply in 1753, intitled "An Essay on the Truth of the Christian Religion, wherein its real Foundation upon the Old Testament is shown." This has been pronounced by good judges one of the best books on that subject. Upon receiving his degree of D.D. at Cambridge in 1726, he is said to have "flood like the stately oak to receive and return back the fiery darts of the orthodox." On the death of Dr. Clarke in 1729, an eulogy of that eminent man was published by Dr. Sykes. He afterwards engaged in a controversy with Dr. Waterland, and in another with Whilton, Chapman, and Douglass, on Phlegon's Eclipse. In 1736 he wrote in favour of the Difenters a tract, intitled "The Reasonableness of applying for the Repeal or Explanation of the Corporation and Test Acts unprofitably condemned;" which was regarded as an able defence of Christianity. His other works were a "Brief Discourse on Miracles," "The Rational Communicant, &c.;" "Examination of Mr. Warburton's Account of the ancient Legislators; of thedouble Doctrine of the old Philosophers; of the Truth of the Jews; and of Sir Isaac Newton's Chronology," 1744; "An Essay on the Nature, Design, and Origin of Sacrifices;" "Two Questions previous to Dr. Middleton's Free Inquiry, impartially considered;" and "A Paraphrase and Notes upon the Epistle to the Hebrews." His publications, which amounted to a very large number, many of them being, indeed, pamphlets, evince his industry. Dr. Sykes suffered much from the gout and stone, but his death was occasioned by a paralytic stroke, which seized him in November 1756, and carried him off a few days after, in his seventy-third year. He had been married, but had no children. In his manners," says his biographer, "he was mild and obligeing, cheerful in temper, and unfournd by the many controversies in which he engaged. He was punctual in the discharge of his public and domestic duties, and passed through life with general respect." Memoirs of the Life and Writings of Dr. Sykes, by J. Dibdin, D.D.

SYL, in Geography, a river of Walachia, which runs into the Danube; 16 miles S. of Krajova.—Alfo, a town of Walachia; 28 miles S.S.W. of Brancovani.

SYLEUS, in Ancient Geography, a town of Asia Minor, in Pamphylia.

SYLAX, a name anciently given to the Tigris.

SYLBURGIUS, FREDERIC, in Biography, a learned philologist, was born near Marburg, in Hesse, in 1546. He passed his early years in the instruction of youth, and in 1565 became a corrector and reader of the editions of ancient authors, printed by Wechel and Comenio. The editions which he superintended are held in high estimation, and his reputation as a Greek scholar was acknowledged by the first writers of his time. He was the author of a Greek grammar much commended by Vossius; and he had a considerable share in Stephensi's Greek Thesaurus. He also composed Greek poems, and some other works, which manifested learning and judgment. He died at Heidelberg in 1596, wrought out by his literary labours. Moreri.

SYLEUM, in Ancient Geography, a town of Asia Minor, situated
SYLLA.

Situated towards the confines of Phrygia, Caria, Lycia, and Pisidia. It was subject to the tyrants of Cibyra and in its vicinity.

SYLLA, Lucius Cornelius, in Biography, a Roman commander, and head of a party, was descended from a branch of the Cornelius family. Funk into indigence and obscurity. He passed a licentious youth, and having acquired the qualities of a gay libertine, he ingratiated himself so much with a celebrated countess of that period, that she bequeathed her whole property. He also was a favourite of his mother-in-law to such a degree, that at her death she made him heir to a large estate. Having thus indulged himself in licentious pleasure and gained wealth, he became the votary of ambition; and succeeded in obtaining the office of questor to the celebrated Marius, at his first consulship, B.C. 107. When Marius went to his African campaign, Sylla was left in Italy to raise recruits, and did not join the army till it was going into winter-quarters. He now began to pursue a course very different from his youth; spending all his time in the fields, undertaking the most laborious duties, and imitating his great commander, whose friendship he thus acquired. Many opportunities soon offered themselves for the exercise and display of his military talents. Being deputed as an ambassador to the court of the king of Mauritania, in an important negotiation, he moved boldly and without molestation through Jugurtha's army, from which circumstance he gained the appellation of Felix. He succeeded in his embassy, and induced Bocchus to become a traitor, and to deliver Jugurtha into his hands. The credit which Sylla thus acquired excited the jealousy of Marius, which was further aggraved by his cauing a signet to be engraved, on which he was exhibited in the act of receiving the illustrious captive. Marius, however, disguised or unfriended his jealousy so far as to avail himself of his services; for when he was appointed to the command against the Cilician Gauls and Cimbrians, B.C. 104, Sylla acted as his lieutenant-general. In this office he was singularly successful; and conceiving himself entitled to civic honours, he went to Rome, and declared himself a candidate for the praetorship. Failing in this acquisition, he accomplished his design in the following year by bribery. When the time of his magistracy expired, he was sent, B.C. 96, into Cappadocia, to settle Ariobarzanes on the throne, and having soon effectuated this business, he received a friendly embassy from Arbaces, king of Parthia; and on occasion of an interview, he manifested his lofty and aspiring disposition, by placing three chairs and seating himself in the middle, whilst those on each side were affixed to Ariobarzanes and the Parthian ambassador. In the Social war, B.C. 91, Sylla had a command in Samnia, and distinguishing himself above all other commanders, he was elected to the consulate B.C. 88, and now commenced the rivalry and Moffit between him and Marius. He was now 50 years old; and he strengthened his interest by marrying Cecilia Metella, daughter of Metellus, the high pontiff. The object of competition between these two aspiring Romans was the command in the Mithridatic war. Sylla having gained the field, succeeded in this attainment of his object; but the measures that were adopted by the partisans of both competitors were violent and fangnariat. The successful competitor having taken possession of the city, and being at the head of six legions, procured articles of impeachment against Marius and his partisans; a decree of proscription, and a price to be set on their heads.

Sylla remained at Rome some time after the expiration of his consulship; but through the influence of Cinna, one of the Marian faction, who had been elected consul, he was cited to give an account of his past conduct. In order to avoid this danger, he embarked his troops, and set sail for the East. Having landed in Thrasybule, he immediately received the submission of the Grecian cities, which had been forced to declare for Mithridates. In order to furnish himself with money for his enterprise against Athens, which refused to surrender, he seized the treasuries of several temples, and violated the sanctity of the Demeter Apollo. After a long siege, Athens was formed with great slaughter of the inhabitants. Having in several battles defeated the forces of Mithridates, he prepared a fleet to pass over into Asia. But being desirous of hastening to Rome, he manifested an inclination to negotiate a peace with Mithridates, with whom he held a conference in person; and they agreed to articles for this purpose. The king professed to reign all his conquests, to confine himself to his paternal territory of Pontus, to pay a large sum of money to the Romans, and to deliver to Sylla the sons of his family; and thus terminated the first Mithridatic war. Sylla possessed unconstrained power in Asia, which he exercised in conferring freedom on several states, which had taken part with the Romans in the late war; and in laying heavy fines upon those which had been hostile. He was thus enabled to carry with him vast treasures to Rome; and he also took with him, as part of the spoils, several valuable libraries, particularly that of Ariobarzanes, which belonged to Apelleion, the Teian, a very wealthy peron, who had expended large sums in forming a collection of rare books. Marius, Sylla's competitor, was now dead, and the chief authority at Rome was vested in Cinna, who had been repeatedly appointed to the consulship, with Carbo, a man equally violent and fangnariat, for his colleague. At Dyraxchium, the deputies of the senate had an interview with Sylla, who was entreated by them not to suffer his resentments to plunge the country in a civil war; but the answer they received led them to conclude that it was determined on ample revenge.

Cinna was killed in a mutiny of his troops; and in the following year, B.C. 83, Cornelius Scipio and Juba Norbanus went to Rome, and on their orders, and the chief authority at Rome was vested in Cinna, who had been repeatedly appointed to the consulship, with Carbo, a man equally violent and fangnariat, for his colleague. At Dyraxchium, the deputies of the senate had an interview with Sylla, who was entreated by them not to suffer his resentments to plunge the country in a civil war; but the answer they received led them to conclude that it was determined on ample revenge. Sylla was killed in a mutiny of his troops; and in the following year, B.C. 83, Cornelius Scipio and Juba Norbanus went to Rome, and on their orders, and the chief authority at Rome was vested in Cinna, who had been repeatedly appointed to the consulship, with Carbo, a man equally violent and fangnariat, for his colleague. At Dyraxchium, the deputies of the senate had an interview with Sylla, who was entreated by them not to suffer his resentments to plunge the country in a civil war; but the answer they received led them to conclude that it was determined on ample revenge.
ruls were successful in various parts of Italy, and Carbo was obliged to withdraw to Africa. Sylla's progres, however, was checked by a new enemy: this was Pontinus Teleinus, a noble Saturnine, who, with an army of 40,000 men, joined the Marian party, which had been always favorable to the rights of the Italian states, and advanced to the relief of Praeneste; but being surrounded by the armies of Sylla and Pompey, he determined to fall upon Rome and hasten towards Rome. Sylla marched speedily to its relief, and rashly attacking Teleinus, exposed himself to danger, and was obliged to fly to his camp. Marcus Claudius, however, falling unexpectedly upon the victors, put them to flight, and Teleinus fell in the action.

Sylla having no longer any enemy to fear, indulged, without restraint, the spirit of revenge by which he was actuated. Having treacherously induced the Saturnines to surrender, he carried about 6000 of them to Rome, caused them to be shut up in the circus, and whilst he was haranguing them, the fold was opened, and the circus was, in indifferently massacred them. The senators, who were assembled in the neighbouring temple of Bellona, heard their cries and groans, not knowing the occasion of them nor the fate that awaited themselves. Sylla, without apparent emotion, continued his discourse, and informed them, that the noise proceedd mostly from some offenders whom he had ordered to be chastised. Praeneste soon after surrendered, and Marius, the consul, escaped the victor's cruelty by a voluntary death. The inhabitants of a military age were ordered to be put to death, and the place was committed to pillage. Sylla, according to Plutarch, was the calm spectator of the promiscuous slaughter of 12,000 men. He now returned to Rome, avowing the sanguine purpose, that he would not spare one who had borne arms against him, but that they should perish to a man. Immediately after, a table of proscription was fixed up, containing the names of 40 senators and 1600 knights, and death was denounced to all who afforded shelter to the proscribed, however nearly related to them, while large rewards were offered to their affianzins. Rome was by these measures made to flow with blood, till at length Sylla was reproached for his cruelties by his best friends. After the murder of about 6000 persons of different ranks, he told the people that he had now proscribed as many as he could think of; but if he recolected any more, they should be added to the number. These proscriptions extended from Rome to all the Italian towns which favoured the opposite party, being accompanied with insults, and in some instances confiscations of the effects of the inhabitants. Sylla's tyranny produced such terror, that no one could venture to rest it, or even to complain, if we except Catone, when a boy. See his article.

After the death of the consul Marius and Carbo, an interrex was created, who, at the suggestion of Sylla, proposed the appointment of a dictator, and that dictator was Sylla himself. After his introduction to the office, he caused to be enacted a number of laws, some of which, if must be acknowledged, were wise and salutary, and continued to be part of the Roman law long after his death. For supplying the places of massacred citizens, with men devoted to himself, he enfranchised 10,000 slaves, and gave them the rights of Roman citizens. He rewarded his legionaries with lands, and decreed himself a triumph on account of his foreign conquests, which was celebrated for two days with extraordinary magnificence. In the following year, B.C. 80, Sylla was both consul and dictator; and in order to acquire popularity, he feasted the whole Roman people. Declining the consulae for the next year, he formed the singular purpose of resigning his dictatorial authority, and returning to the condition of a private citizen. This must be regarded as a resolution, which in its situation, and in reference to his past conduct, was very extraordinary. For the execution of his purpose, he assembled the people, and concluded his address to them, by saying that he was ready to give an account of his whole administration, and to answer in his private capacity any accusation that might be brought against him. He then dismissed his lieutenants, descended from the rostra, and before the astonished multitude walked for some time in the forum, conversing familiarly with his friends. After his retirement from power to private life, he disgraced himself by the most dissolute company and manners. Having lost his wife Metella, he again married Valeria, sister to the orator Hortenius; but she could not refrain him from indulging in low and scandalous amours. His intemperance occasioned a loathsome disease, from which no art could relieve him. He died in the year B.C. 78, at the age of 60, and his funeral was singularly magnificent. The meaning of the epitaph which he composed for himself was this, that "he had returned with interest all the good he had received from his friends, and all the evil from his enemies." Sylla might well claim the epithet of "Fortune." Fortune was the goddes to whom he attributed all his successes, and with the superstition common among the heathens, he would not offend her by affuming to himself the merit of his actions. The belief that he was her favourite, which he derived from the predictions of astrologers, inspired him with courage in his enterprises, and induced him probably to that act of his life, which was upon the whole the most remarkable, the renunciation of his power. Plutarch Vit. Sylla. Un. Hist. Gen. Biog.

SYLLABA, Lat. a name given by some of the ancients, and among others by Nichomachus, to the consonance of the fourth, which they commonly call diastroron; and which proves, by its etymology, that the Greeks regarded the tetrachord in the same light as we regard the octave, including within its compass all the radical sounds of a syllable.

The modern Italian fissing-masters call solmisation by the hexachords, syllabicising; and ascending and descending the scale by the vowels, vocalising.

SYLLABIC, in the Greek Grammar. There are two kinds of augment es; the first called syllabic, which is when the word is increased by a syllable; the other temporal, which is when a short syllable becomes long.

SYLLABLE, SYLLABA, in Grammar, a part of a word, of an articulate sound, consisting of one or more letters, which are pronounced together; or which in itself conveys either no idea, or part only of what is denoted by the word. The word is derived from the Greek σύλλαβη, which literally denotes comprehension or affimiation.

Or, a syllable is a complete sound, uttered in one breath, consisting either of a vowel alone, or of a vowel and one or more consonants, not exceeding seven.

Scaliger defines a syllable to be an element under one tone or accent, that is, which can be pronounced at once.

Prícin, more intelligibly, calls it a comprehension of several letters falling under one accent, and produced at one motion of the breath. But some grammarians reject this definition, as excluding all syllables of one letter.

Another defines syllable, a literal or articulate voice, of an individual sound.

The learned bishop Lowth defines syllable, a sound, either simple or compound, pronounced by a single impulse of the voice, and constituting a word or part of a word.

In every word, therefore, there are as many syllables as
there are vocal sounds; and as many vocal sounds, as there
are simple or compound vowels, each of which requires a
distinct motion of the pharyngeal muscles. Thus, a, a, a,
make three syllables, formed by 30 many motions, distin-
guished by small flops betwixt each expiration.

In the Hebrew, all the syllables begin with consonants, al-
lowing aleph to be one; nor has any syllable more than a
single vowel.

From the number of syllables in words, they become de-
nominated monosyllables, bisyllables, trisyllables, and polysyllables,
g. d. words of one syllable, two syllables, three syllables,
and many syllables.

As it is the number of syllables that constitutes the mea-
sure of English verse, it were to be wished we had fixed and
settled rules to determine the precise number of syllables in
each word; for we have words very dubious in that respect;
and there are even some which have more syllables in verse
than in profe. Many of the words ending in inus, occasion
great embarrassment to such as pique themselves on exact-
ness: as odious, precious, &c.

With respect to the division of syllables, we may observe,
that any letter, or combination of letters, which will begin
a word, may likewise begin a syllable in the middle of a
word, and no other; for each syllable being as much a per-
fected sound as a more syllable word, can properly commence
with such letters only as will suit the beginning of a word.
Accordingly, there is no letter in the English language, that
may not begin a word, except e mute, which therefore in
the middle of words always goes with the former syllable.
Moreover, every syllable ends in the middle of a word, when
a sound is complete, and the next letter or letters will begin
a new syllable, of which the first at least is a consonant,
unless where two vowels meet, which do not unite in a
diphthong. However, there are some few exceptions to
this general rule.

A syllable in the beginning or middle of a word ends in
a vowel, unless it be followed by s, or by two or more
consonants, which are for the most part to be separated;
and at least one of them always belongs to the preceding
syllable, when the vowel of that syllable is pronounced
short. Particles in composition, though followed by a
vowel, generally remain undivided in spelling. A mute
generally unites with a liquid following; and a liquid, or a
mute, generally separates from a mute following: e, and e,
are never separated from a preceding mute, e. g. ma-nis, is

But the best and easiest rule for dividing the syllables
in spelling, is to divide them as they are naturally divided in a
right pronunciation; without regard to the derivation
of words, or the possible combination of consonants at
the beginning of a syllable. See this subject pursued in
Ward's Essay upon the English Language, p. 44, &c. See also
Lowth's Introduction to English Grammar, p. 23; and

With regard to the accenting of syllables, to what has
been delivered under Accent we may here add, that all
words of one syllable have either an acute or circumflex
accent, agreeably to their quantity. In words of more than
one syllable, the Latin and Greek language differ very much
from each other, as to the use of accents. Many words
of two or more syllables, are accented on the last syllable
in Greek, but none in Latin, except a few compounds of
fio, as maleis, &c. In words of more than two syllables,
if the penultima is long, the Latin accent is placed there,
otherwise on the antepenultima. But in Greek words it is
sometimes placed on the antepenultima when the penultima
is long, and at other times on the last syllable; but when
this is long, it is never carried farther back than the pen-
tulima. No word in the Latin or Greek language is ac-
cented farther from the end than the antepenultima.

English words are not only accented upon each of the
two last syllables, but several upon the fourth, and some
few upon the fifth from the end. In pronouncing long
words, a variation of the tone is necessary upon some other
syllable, besides that where the accent is placed, though
not equally high, both for the sake of casting the voice, and
modulating the sound. Many English nouns and verbs
written alike, are distinguished from each other, by pro-
nouncing the former with an acute accent on the penultima,
and the latter on the last syllable: as subject and object,
image and image, &c. In the inflections of verbs, the accent
always remains on the root, as love, loved, loves, &c. In
derivatives, the accent is always on the theme, except sub-
finitives from the French, ending in eer and ier, where it is
carried to the termination, as volunter, &c. Most com-
ound words have their accent on the former part, and
which is a preposition, and then often on the latter. But
the exceptions from either are more easily known from ob-
ervation than reduced to any certain rules. If the accent
be on the vowel, a vowel or syllable is long, as fall; a
syllable is short, when the accent is on the consonant, which
occupies the word, it will be quickly joined to the preceding
letter, as ans, hungär. Unaccented syllables are generally
short, as admir, but this rule has many exceptions, as in-
pire, firendly. When the accent is on a consonant, the
syllable is often more or less short, as it ends with a single
consonant, or with more than one, as fiddly, persif. When
the accent is on a semi-vowel, the time of the syllable
will be protracted, by dwelling upon the semi-vowel, as ar,
can't but when the accent falls on a mute, the syllable
cannot be lengthened in the same manner, as abed. With
a mixture of long and short syllables are the most
melodious. Ward, ubi supra, p. 32, &c. Murray's Gram-
mar, vol. i.

SYLLABES, Quantity of. See Quantity.
SYLLABUB, a kind of compound drink, made of
in the summer season; ordinarily made of white wine
fugger, into which is sifted new milk with a syrinx, or
wooden cow.

Sometimes it is made of canary, in lieu of white wine:
in which case the fugger is spared, and a little lemon and
muscat added in lieu of it, e. g. musca-
To prepare it the best way, the wine and other
agents, excepting the milk, are to be mixed over snow, and
the milk or cream added in the morning. The proportion
is, a pint of wine to three of milk. For
SYLLABUB, Whips, to half a pint of white wine or
Rhineh, is put a pint of cream, with the whites of three
eggs. This they feast on with fugger, and beat with broken
rods, or work with a syrinx. The froth is taken off
it rises, and put into a pot; where, after standing for two
or three hours, it is fit to eat. Rout.

SYLLECTUM, in Ancient Geography, a maritime town
of Africa Propria, a league from Carthage, according to
Procopius.

SYLLEPSIS, in Grammar, conception, a figure by which
we conceive the sense of words otherwise than the words
import; and thus make our construction, not according to
the words, but the intention of the author. See Sub-
stitution.

The syllepsis, says an ingenious author, is a figure
of construction, which agrees rather with our ideas than
with the words; and expresses rather the sense of our mind
than the sense of the terms themselves.
Syllogism is also used for the agreement of a verb, or adjective, not with that word next it, but with the most worthy in the sentence: as rex et regina beats.

Some authors call the syllogism, synthesis; others, substantiation. It is a figure of considerable use for the well understanding of authors. Scoppius divides it into two kinds, simple and relative. The former is when the words of a discourse either disagree in gender, or number, or both; and the latter is, when the relative is referred to an antecedent which is not expressed; but which we conceive by the sense of the whole period.

**SYLLOGISM.** In *logic*, an argument, or form of reasoning, consisting of three propositions: having this property, that the conclusion necessarily follows from the two premises; so that if the first and second propositions be granted, the conclusion must be granted in like manner; and the whole allowed for a demonstration.

If the premises be only probable, or contingent, the syllogism is said to be dialectical; if they be certain, apodictical; if false, under an appearance of truth, sophistical or perologiastic.

As often as the mind observes any two notions to agree to a third, which is done in two propositions; it immediately concludes, that they agree to each other: or if it find, that one of them agrees, and the other disagrees, which is likewise done in two propositions; it immediately pronounces that they disagree to each other. And such is a syllogism; which, it hence appears, is nothing but a mental discourse, or reasoning, by which, from any two propositions granted, a third is necessarily deduced.

Hence, as the Greeks call it *syllogism*, the Latins call it *collectio*, or *rationes*, as being a kind of composition, which, either by adding, or subtracting, gathers either the sum or the remainder: for, as we add two and three, we may thence collect five: so, if to this proposition, "man is an animal," you add this, "every animal thinks," you thence deduce this, "therefore man thinks."

Of the three propositions of which a syllogism consists: the first is, by way of eminence, called the *proposition*, as being proposed for the basis of the whole argument; the second is called the *assumption*, as being assumed to assist in inferring the third: though they both are called *suggestions*, because assumed for the sake of the third; and both premises, as being premised to it; and for the same reasons both are called *antecedent*, only the first the major, and the latter the minor.

The third is called the *conclusion*, as being the close of the whole argumentation; and sometimes *conclusio*, as including the two notions, before separately compared; and *consequent*, because it follows from the antecedent; and lastly, *illatio*, because inferred from the premises by means of the illative particle *ergo*, therefore, &c.

As the conclusion is the principal part of a syllogism, it hence arises, that though both the proposition and assumption consist each of its subject and attribute, yet the subject and attribute of a syllogism are properly understood of those of the conclusion.

Again, in the instance above mentioned, *animal* being used both as subject and attribute, it is held a kind of intermediate between the two, and frequently called *medium*; in respect to which, both the subject and attribute, *man* and *thinks*, are called *extreme* or *term*; only the subject the *greater extreme*, and the attribute the *less*.

In the constitution of a syllogism, we may consider the matter and the form of it. The matter is three propositions made up of three ideas, or terms, variously joined. The three terms are named the *major*, *minor*, and *middle*.

The predicate of the conclusion is called the *major term*, because it is generally of larger extent than the minor term, or the subject. The major or minor terms are called the *extremes*. The middle term or medium is the third idea invented and disposed in two propositions, in such a manner, as to shew the connection between the major and minor term in the conclusion; whereas the middle term is sometimes called the *argument*. The proposition, which contains the predicate of the conclusion, connected with the middle term, is usually called the *major proposition*, whereas the minor proposition connects the middle term with the subject of the conclusion, and is sometimes called the *assumption*. The major proposition is generally placed first, the minor second, and the conclusion in the last place, when the syllogism is regularly composed and represented.

The form of a syllogism is the framing and disposing of the premises according to art, or just principles of reasoning, and the regular inference of the conclusion from them.

Syllogisms are distributed, with regard to the question to be proved, into *universal affirmative*, *universal negative*, *particular affirmative*, and *particular negative*: and with respect to their nature and composition, into *single* and *compound*. Single syllogisms are made up of three propositions, and may be divided into *simple*, *complex*, and *compound*.

Simple or *categorical* syllogisms are made up of three plain, single, or categorical propositions, in which the middle term is evidently and regularly joined with one part of the question in the major proposition, and with the other in the minor, whence follows a plain single conclusion. For complex syllogisms, see *Complex*.

*Conjunctive* syllogisms are those, in which one of the premises, viz. the major, has distinct parts, joined by a conjunction, or some such particle of speech; the chief of which are *conditional*, *disjunctive*, which have the major proposition *disjunctive*; *relative*, requiring the major proposition to be *relative*; and *conditional*, or *categorical*, which require that two or more ideas be connected either in the complex subject, or predicate of the major, that if one of them be affirmed or denied in the minor, common sense will shew what will be the consequence.

*Compound* syllogisms are made up of two or more single ones, and may be resolved into them: the chief kinds are *epichoresis*, *dilemma*, *prosyllogism*, and syllogism. Watts's *Logic*, art. iii. c. 3.

A syllogism, wherein one of the premises is suppressed, but so as to be understood, is called an *enthymeme*, e. g. "every animal thinks, therefore man thinks!" in which the proposition, "man is an animal," is understood.

The demonstrations of mathematicians, it is observed, are only syllogisms of enthymemes: so that every thing in mathematics is concluded or proved by syllogism; only omitting such premises as occur of their own accord, or as are referred to by the citations. (See *Syllogism*.) There are two general methods of reducing a syllogism to a test of their truth or falsehood. The first is, that the premises must contain the conclusion, or one of them must contain the conclusion, and the other must shew that the conclusion is contained in it; and the second is, as the terms in every syllogism are usually repeated twice, they must be taken precisely in the same sense in both places. Watts, ubi supra.

As to the advantage which syllogism affords to reason, Mr. Locke observes, that of four things, which reason is employed about; viz. the finding out of proofs, the regular disposition of them so as their connection may appear, the
the perceiving of their connection, and the making of a
right conclusion; syllogism only assists in one, viz., shewing
the connection of the proofs in any instance. Nor is it of
any great use even here; since the mind can perceive such
connection, where it really is, as easily, nay perhaps better,
without it. We fee men reason very strongly who do not
know how to make a syllogism.

Indeed syllogism, the fame author adds, may serve to
discover a fallacy in a rhetorical flourish, or by tripping
an absurdity of the cover of wit and good language, shew it
in its natural deformity. But it only shews the weaknesses or
fallacies of such a discourse by the artificial form it is put
into, to those who have thoroughly studied mood and figure,
and have so examined the many ways three propositions may
be put together in, as to know which of them does cer-
tainly conclude right and which not, and upon what grounds
they do so.

The mind is not taught to reason by these rules: it has a
native faculty of perceiving the coherence or incoherence of
its ideas, and can range them right without such perplexing
repetitions. Add, to shew the weaknesses of an argu-
ment, one need not more, than to sketch it of the super-
ficial ideas, which blended and confounded with those on
which the inference depends, seem to shew a connection
where there is none; or at least hinder the discovery of the
want of it: and then to lay the naked ideas, on which the
force of the argumentation depends, in their due order.
In this position, the mind taking a view of them, sees what
connection they have, and so is able to judge of their inference,
without any need of syllogism at all.

Nor must it be omitted, that syllogisms are as liable to
fallacies, as the plainer ways of argumentation; for which
one might need no more, than to imagine an old man
common observation, which has so many ways esteemed these artificial methods of reasoning more
adapted to catch and entangle the mind, than to instruct and
inform the understanding. And if it be certain that fal-
cacy can be couch'd in a syllogism, as nobody will deny but
it may, it must be something else, and not a syllogism, that
must discover it.

The fame author proceeds to shew, that this way of rea-
soning discovers no new proofs, nor makes any discoveries;
but is wholly converfent in the marshalling and ranging of
those we already have; a man must know, before he be able
to prove syllogistically; so that the syllogism comes after
knowledge, when we have but little need of it. To the
same purpose it is observed by Dr. Campbell, in his "Phila-
osophy of Rhetoric," that the method of proving by syl-
logism appears, even on a superficial view, both unnatural
and prolix. The rules laid down for distinguishing the
conclusive from the inconclusive forms of argument, the
tru syllogism from the various kinds of sophism, are at once
cumbersome to the memory, and unnecessary in practice.
No person, one may venture to pronounce, will ever be
made a reasoner, who stands in need of them. In a word,
the whole bears the manifest indications of an artificial and
ostentatious parade of learning, calculated for giving the
appearance of great profundity, to what is, in fact, very
shallow. See Reason and Logic.

SYLLOGISM, Figure and Mood of a. See Figure and
Mood.

SYLLOGISMS, Reduction of. See Reduction.
SYLLOGISTIC FORM. See Form.

Syll, the principal of the Hebrew accents, used to
close a period, and called king and prep. It is marked
under a letter thus ( ).

SYLT, in Geography, an island of Denmark, in the
North sea, about 12 miles from the W. coast of the duchy
of Sleswiek, of an irregular form, about 40 miles in cir-
cumference, and no where more than two miles from the
sea. N. lat. 54° 35'. E. long. 8° 30'.

SYLVA, among the Romans, a ludicrous kind of hunt-
ing exhibited in the circus; so called, because the circus
was really planted with trees, which had been dug up with
the roots by the soldiers and brought thither, and tied to
large beams, after which earth being thrown upon their
roots, the circus actually resembled a wood; there was
then filled with all sorts of herbivorous animals, the peo-
ple were let loose upon them, and carried all clear off.

SYLVA, or Sylvus, in Poetry, a poetical piece composed,
as it were, at a flint; or in a kind of rapture or transport,
and without much thought or meditation. Such are de
Sylva of Statius, which, he affirms us, were all composed
after this manner.

Quintilian extends the use of the word sylva to any wir-
ing done in hafhe, and on the spot.

The word is Latin, and literally signifies forst; whose
its chief use in our language is metaphorically to express
certain collections of poetical pieces of various kinds, on
various subjects; as a forest is an assemblage of trees of
different sorts.

SYLVANS, in Mythology. See FAUNS, SATYRS, el
SILVI.

SYLVES, in Geography. See SILVEs.

SYLVIUS, Francis, De le Boe, in Biography, a dis-
tinguished physician, and founder of a sect in medicine,
as born at Hanau in 1614, and was defended of a good f
amily. After the usual grammatical education, he was sent
to the university of Bafié, where he commenced the way
of physic, and received the degree of doctor in that folly
in 1677. In order to inform the learned of different in-
scriptions, he visited several of the principal universities
in France and Germany, and became extremely skilful in
anatomical pursuits and in the pharmaceutical branch of
chemistry. Being thus qualified to enter upon the profes-
sion of his profession, he settled first at his native place; but
looking to higher advantages, he removed to Amsterdam,
and obtained a distinguished reputation among the physi-
cians of that capital, which he continued to enjoy several
years until he was called to Leyden, in 1658, to assume the
place of professor of the practice of medicine in that uni-
nityr. This situation was well calculated for the exercise
of his genius and eloquence, and he soon attracted a nu-
sous audience from all parts of Europe. He was one of
the earliest advocates for Harvey's doctrine of the circula-
tion of the blood, and was the principal cause of its re-
ception into that medical school. In other respects, how-
ever, he was instrumental in retarding the progress of med-
ical science, by the invention of an hypothesis respecting
the cause of diseases, which contributed much to excite the
attention of the medical world, and to extend his own name.
He ascribed all the most important operations of the vital
forces to certain chemical operations, to fermentations, and
conjunctions, which he believed gave origin to an excess of sol.
alkali, to the neutralization of which all the efforts of
the medical art were of course to be directed. Whence he
administered volatile alkalii, absorbent earths, and cords
largely, paying little regard to the different stages of dis-
order, or the character of prevailing epidemics. The ex-
tent to which this doctrine was received and defended in
most parts of Europe, founded as it was upon a generous
hypothese, and therefore productive in many cases of much
mischief, is surprising, and the interruption which it op-
tioned to the improvement of medicine was considerable.
It was in fact one of the greatest benefits which Sylvius
conferred.
SYL

conferred upon the art, to have detached physicians from this and other hypothetic systems, and led them to the only true path of inquiry, that of observation and experience. The works of Sylvius were principally controversial threads, in which the doctrines which he propounded were flated and defended; and they were frequently reprinted during the prevalence of the system; but they have long been confounded to the neglect, which a mass of fanciful speculation is sure to experience when the light of the day is thrown upon it, and an ultimate incursion. Sylvius died at Leyden in 1672, at the age of 56. See Eloy Diet. Hist. Gen. Biog. See also Medicine, History of.

SYLV\VUS, JAMES, Du Bois, a learned physician, was one of the fifteen children of a camlet manufacturer at Amiens, where he was born in 1478. His elder brother being professor at the college of Tournay in Paris, and a great promoter of learning at that dark period, James had the opportunity of acquiring under him a more perfect knowledge of the Latin and Greek languages than was usual at the time. When he had determined upon adopting the profession of physic, he applied himself most assiduously to the perusal of the writings of the ancients, especially of Hippocrates and Galen, of the latter of whom he was all his life a zealous disciple and defender. But he was not less affluence in the pursuit of other branches of medical study, and especially in experimental researches in anatomy, pharmacy, and botany, and he made several journeys for the purpose of examining medicinal plants in the countries where they were produced. Upon his return to Paris, he delivered a course of lectures, in which he expounded the whole circle of medical practice from the works of Hippocrates and Galen, and in the course of two years obtained a reputation, which attracted to his school a crowd of pupils from various parts of Europe. This, however, did not fail to excite the jealousy of the Parian physicians, particularly as he had not yet taken a medical degree, and he was under the necessity of going to Montpellier in 1520, for the purpose of graduation. But his extreme avarice, which accompanied him through life, would not permit him to undergo the necessary expenses at that university, and he returned without a degree. After some time, however, he succeeded in compromising his differences with the Parian faculty, and was admitted a bachelor of physic in 1531. Four years afterwards he became a lecturer at the college of Triquet, while Fernel taught in that of Cornouaille; and he was attended by a numerous train of students; while the latter attracted but few. His anatomical dissections, and his lectures on botany and pharmacy, which were omitted by Fernel, were probably the principal cause of this preference. He was appointed professor of medicine at the royal college in 1550, which he continued to hold till his death, which took place in 1556, in the seventy-seventh year of his age.

This physician was never married, and is said to have shown an aversion to the other sex. His manners were rude, and his temper full; and his parimony so extraordinary, that he is reported to have used no fire in the winter, but to have kicked a foot-ball, and carried a log of wood up and down stairs, to keep himself warm. He was such a friend to parsimony, indeed, that he published a tract for the benefit of poor scholars, entitled, "De Vitiis ratione facili et salubri Pauperum Scholasticiarum." In fact, his passion for money obfuscated the lustre of his many great qualities. His works were popular during the reign of the old school, but are now obsolete. As an anatomical writer he merits the greatest praise; for though he had few opportunities of human dissection, he made various discoveries and improvements, which are contained in his "Insegni Anatomica," and in his "Obeserva in variis Corporibus fecundis." Several of his writings related to the subject of pharmacy, in which he was well skilled for the age; and he published a valuable edition of Mefius, with a translation and comments. He wrote with great violence against Vesalius, who had been his pupil, and became his rival in anatomy; but especially on account of his presumptuous in correcting Galen, whose very errors he was led to defend by his bigoted attachment to the ancient. Sylvius was also author of a French grammar; he had studied mathematics very successfully; and had cultivated mechanics so far as to have gained considerable notoriety with the public by some machines of his invention. Gen. Biog. Hutchinson, Biog. Medica.

SYL\\RU\\S, in Ichthyology. See Silurus.

SYMA, or SY\\ME, in Ancient Geography, an island north of Rhodes, at the entrance of a small gulf of the Doride. The ancients represent it as having been inhabited by Chthonius, the son of Neptune and Syme, and as having been peopled by the Carrians after the war of Troy; and when abandoned by them, as having been occupied by a colony of Lacedaemonians and Argives. See Syme.

SYMB\\CA\\CA\, a town of Alba, in Media, according to Strabo.

SYMBACCHI, συμβαχχιον, in Antiquity, a designation given to the two men, who purified the city of Athens at the festival Thargelia.

SYMB\\ARD, or SYM\\ARD, in Geography, a town of France, in the department of the Saone and Loire; 4 miles N. of Louhans.

SYMBOL, Symbolum, formed from νυ\\μας, a mark, sign, or badge, of νυ\\μαςα, to compare, a sign or representation of any moral thing, by the images or properties of natural things.

Thus we lay, the lion is the symbol of courage; the pelican of paternal love, &c. Symbols were in very great repute among the ancient Hebrews, and especially among the Egyptians; and served to cover a great part of their moral mysteries; being used not only to represent moral things by natural, but even natural by natural.

Symbols are of various kinds, as types, enigmata, parables, fables, allegories, emblems, hieroglyphics, &c.; each of which see under its respective article, Type, Enigma, Parable, Fable, &c.

The Chinesse letters are most of them absolute symbols, or significative. The symbols in algebra, &c. are arbitrary. Medallists also apply the term symbol to certain marks or attributes peculiar to certain persons or deities. The thunderbolt, for instance, accompanying the heads of certain emperors, is a sign or symbol of the sovereign authority, and of a power equal to that of the gods: the trident is the symbol of Neptune; the peacock of Juno; a figure seated on an urn, of a river, &c. See Medal.

Symbol, among Christian, is particularly used for the creed, or the articles of religion, which every Christian is to know and believe. See Apostles' Creed.

In the emperor's library is a Greek MS. of the symbol of the apostles, divided into twelve articles, with the names of the respective apostles, who are said to have composed each article. The first is attributed to St. Peter, and the rest successively to Andrew, James major, John, Thomas, James minor, Philip, Bartholomew, Matthew, Simon, Thaddæus, and Matthias.

But the testimony of that MS. does not much confirm the opinion, that each apostle composed an article of the symbol;
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symbol; yet the opinion is, at least, as old as St. Leo, who seems to have believed it.

Authors are in doubt why the name symbol should be given to this compendium of the articles of the Christian faith: some say, it is thus called in allusion to a military custom; that as soldiers were known by signs and tokens, this was to be the mark or characteristic of a Christian. To the purport of Rufinus says, that the Greek word συμβολος may be rendered in Latin by indicium. Others derive it from an assembly or conference of the apostles, where each expressing his sense of the faith, and what each had chiefly preached, the creed was framed, and called by the Greek word συμβολη, which signifies collection or conference.

Lord King derives the signification of the word with greater probability from the sacra, or religious services of the heathens, where those who were initiated into mysteries had certain signs or marks, called symbols, delivered to them, by which they might know each other, and claim admission to the secret worship and rites of that god, whose symbols they had received. He produces many instances of the common use of symbols, both mute and vocal; and in allusion to these he apprehends the creed is thus called, because it was studiously concealed from the Pagan world, and not revealed to the catechumens themselves, till they were initiated by baptism into the visible church; when it was delivered to them, as that secret mark or sign, by which they should be known from all others, and mutually know each other. Hist. of Apostles' Creed, p. 11, &c.

SYMBOLS of Pythagoras. See Pythagoreans.

SYMBOLICAL Characters, Column, Fountain, Fountains. See the subjoined.

SYMBOLICAL Philosophy. See Hieroglyphic.

SYMBOLICAL Physics. See Physics.

Clemens Alexandrinus, Eusebius, &c. observe, that the Egyptians had two ways of representing their sibylline mysteries: one by the virtues of animals, herbs, &c.; the other by geometrical figures. Thus, the sun and moon were represented, in the first manner, by the beetle and ibis; and in the latter, by their own figures. Again, the four elements they represented, after the first manner, by four animals which have qualities corresponding thereto; and after the second manner by +.

SYMBOLISM, a word used by some of the chemical writers to express a confused part of.

SYMOLOGICE, is used by some for that part of the science of medicine, which treats of the symptoms of diseases.

SYMBOLUM, in Ancient Geography, a place of Thrace, between the town of Neapolis and that of Philippos; so called by the Greeks, according to Dion Cassius, because the mountain denominated Symbolus here joined another mountain, which extended into the middle of the country.

SYMBRA, a town of Asia Minor, in the interior of Lycaia, according to Ptolemy.

SYME, See Syma.

SYME, in Geography, an island in the Grecian Archipelago, situated near Cape Volpe, on the coast of Carmania, at the entrance of a gulf which bears its name. Although this island is scarcely two leagues in length, by one in breadth, it has two good harbours fit for the reception of large ships, without reckoning several little bays or coves, in which small craft may find shelter. The north harbour, barred by shoals, is the most spacious as well as the most commodious. The most northern of the shoals which protect its entrance is named San Paolo, because it is opposite to a place of that name, on the coast, at the very head of the gulf. On the other side of Symia the gulf is formed by Cape Crio. Symi was formerly cultivated, and fertile in grain; but at present there are discoverable hardly any vestiges of its ancient culture. Its inhabitants are almost wholly occupied in the fisheries of sponges, which cover the rocks at the bottom of the sea that surround their island. They are reckoned the boldest and most experienced men in the world, diving into the sea to the depth of 120 feet, and there detaching the sponges from the rocks to which they adhere; and having done this, they rise to the surface of the water, in order to take breath for a few moments, and then dive again. The Symiots are also excellent good navigators: with very small boats they cross the intervals of sea which separate them from the coasts, and from the other islands; and, with the produce of their sponges, they carry thither the fruits of their activity, which afford a small traffic, adequate to the wants and ambition of a nation of divers. They are a robust race of men, of a handsome stature. The life of these islanders is simple; and tyranny has spared, or, more properly speaking, defined a tribe, which, in lieu of opulence, presents only a few habits and laborious occupations, the most certain pledge of independence. N. lat. 36° 28'. E. long. 27° 34'.

SYMITHA, in Ancient Geography, a town of Africa, in the interior of Mauritanias Caetariensis. Ptolemy.

SYMMACHUS, Q. Aurelius Avianus, in Biography, a Roman senator of the fourth century, became prefect of Rome, pontiff and augur, and pontiff of Africa. He vigorously refuted the changes that were made in the national religion by the triumphs of Christianity, and headed a deputation from the senate to the emperor Valentinus II., begging the re-establishment of priests and veils, and of the altar of Victory. This application was refused by St. Ambrose, bishop of Milan, who composed an answer to the petition of Symmachus, as did also the poet Prudentius. Symmachus lost his cause, and for some reason was banished by that emperor, or by Theodosius, the latter of whom recalled him, and raised him to the consulate A.D. 391. The petition above-mentioned is preserved in the tenth book of Symmachus's Epistles, still extant. His oratory was of that kind which charactarized the decline of Roman literature. "The luxuriancy of Symmachus," says Gibbon, "confined barren leaves, without fruits, and even without flowers. Few facts, and few sentiments, can be extracted from his verbose correspondance." Of these epistles the best edition, as far as the text is concerned, is that of Scholius, 4to. Augment. 1668. Moreri. Gibbon.

SYMMACHUS, Pope, a Sardinian, and deacon of the Roman church, whose elevation to the pontifical chair terminated a schism which took place in the church at the decease of pope Anastasius II., in the year 498. His opponents attempted to depose him, and laid before Theodoric, king of the Goths, a charge against him of various crimes, requesting that a delegate of his appointment would take cognizance of the cause upon the spot. The emperor summoned the pope; and the tumults at Rome, which had subsided on his election, were universal. Theodoric visited the city, and pacified its disturbances. He summoned a council, which assembled at Rome in July 500, and Symmachus, being summoned to appear, proceeded from the college of pope Anastasius II., attended by a great body of the populace. These were encountered by the opposite party, and in the conflict Symmachus was wounded, and with difficulty made his escape to St. Peter's. At the final meeting of this council, a decree passed, in which Symmachus was acquitted of the crimes laid to his charge, and all persons were enjoined to submit to his pontifical authority, on pain of excommunication. It was on this occasion that the petition
position was first advanced, that no assembly of bishops is authorized to judge the pope, who is accountable for his actions to God alone. In 503, Symmachus held a council at Rome, in which the law of Odoacer, declaring that the election of a pope could not be made without the concurrence of the sovereign, was annulled; and another council, held in 503, confirmed the acts of the council which had abdicated Symmachus; and another was convened in 509, which passed a decree, anathematizing all who should fease or appropriate the goods or estates of the church, though they held them by grants from the crown. Towards the close of his pontificate he made various regulations for reforming discipline in the churches of the West, and he expended large sums out of the papal revenues on religious edifices, and for the support of the Catholics, who were persecuted in Africa. He died in 514, and received the honour of canonization. Eleven of his epistles, and several of his decrees, are extant. Moreri. Bower.

SYMMETRY, συμμετρία, formed from σύμμετρος, with, and μέτρον, measure, the relation of parity, both in respect of height, length, and breadth of the parts necessary to compose a beautiful whole. Comments on how Symmetry, according to Vitruvius, consists in the union and conformity of the several members of a work to their whole, and of the beauty of each of the separate parts to that of the entire work; regard being had to some certain measure: so that the body is framed with symmetry, by the due relation which the arm, elbow, hand, fingers, &c. have to each other, and to their whole.

Symmetry arises from that proportion which the Greeks call analogy, which is the relation of conformity of all the parts of a building, and of their whole, to some certain measure, upon which depends the nature of symmetry.

SYMMETRY, Uniform, in Architecture, is that where the fame ornamentation reigns throughout the whole.

SYMMETRY, Reflection, is that where only the opposite sides are equal to each other.

Under the article Veterinary Anatomy, it was proposed to discuss at large the subject of the symmetry of horses; but we now find that our limits will merely allow of our referring to that article, and also to that of Horse. See also Bacteriology.

SYMPARATAXIS, a word used by Hippocrates to express the confidé between nature and disease, and the agents or medicines given in it.

SYMPASMA, a word used by many authors to signify a cataplasm.

SYMPATHETIC, συμπαθητικός, something that has a sympathy; or that acts, or is acted on by sympathy.

SYMPATHETIC, in Anatomy, an epithet applied to two nerves, from the idea that their communications are the cause of sympathies. One of these is the sympathetic maximus, or great intercostal nerve; the other is the facial, called sympathetic minor by Winslow. See Nerve.

SYMPATHETIC is particularly applied to all diseases which have two causes; the one remote, the other near. In which sense, the word is opposed to idiopathic.

Thus, an epilepsy is said to be sympathetic, when produced by a remote cause; i.e. when the disorder in the brain, embarrassed with blood, is preceded and produced by some other disease.

There is sympathetic palpitation of the heart, and an idiopathic one. There is but one idiopathic cause of the palpitation; but there are several sympathetic ones.

Among chemists and alchemists, the term sympathetic is principally applied to a kind of powder and of ink.

SYMPATHETIC Ink. See Ink.
nefs, &c. &c. These are called sympathies, or content of parts. An organ, to which no direct application is made, suffers in consequence of what is done to another. See, for a further account of this subject, Nervous System, under the head of Nerves of the animal life.

We have some practical remarks on the sympathy of the parts of the body, in the Medical Essays of Edinburgh, vol. v. part 2. art. 45.

For the force and effect of sympathy, in the production of monsters, see Monster.

SYMPHESIS, a word used by the old Greek writers to signify connection or digestion.


Gen. Ch. Cat. none, unless the corolla be so denominated. Cor. regular, or four oblong, equal, deciduous petals, cohering at the base. Nectaries none. Stam. Filaments four, inserted into the middle of each petal, linear, cohering at their upper part; anthers terminal, oblong, dilated. Pilt. Germ. four, similar to the rudiments of two seeds; style simple; stigma rather abrupt. Peric. Nut cylindrical, with a solitary kernel.


A genus of humble shrubs, or herbs, either smooth, or bearing a few flatter glandular hairs. Leaves in three deep, divided segments; the lower ones opposite. Sepals simple, terminal, and partly from the bottoms of the uppermost leaves. Flowers yellow, alternate, sessile, with foliaceous, hooded, permanent bracteas. Mr. Brown considers his Symphionema as not particularly allied to any other, except perhaps to his Agathachys, which has separate filaments, and an unilateral stigma. Two species only are known.


2. S. montanum. Symphonema. Br. n. 2.—Segments of the leaves flat, linear, fine-ribbed. Bracteas and flower-flalk downy, with very short glandular hairs.—Gathered by the same botanist, on moist rocks, in the same neighbourhood.


Gen. Ch. Cat. Perianth inferior, of five roundish, spreading, imbricated leaves, permanent. Cor. Petals five, roundish, rather coriaceous, concave, much larger than the calyx, folding obliquely over each other, and converging, so as to form a slightly depressed globe. Stam. Filaments united into a circle, even, cylindrical tube, the length of the petals, slightly inflated at the bottom, sheathing the fyle; anthers five, ovate, acute, sessile on the margin of the tube, spreading. Pilt. Germ. superior, ovate; fyle cylindrical, rather longer than the corolla; stigmas five, oblong, acute, spreading, alternate with the anthers. Peric. berry globose, of five cells. Seeds solitary, nearly globular, smooth, flat, rather oval, the inner side.

Eff. Ch. Calyx of five leaves. Corolla globose, of five petals, folding obliquely over each other. Style one. Berry superior, of five cells. Seeds solitary.

1. S. globulifera. Linn. Suppl. 502. (Moronoboa esculenta; Aubl. Guian. 788 t. 353. f. a–x ?)—Native of Surinam, from whence Dalberg first specimens, preferred a spiritus, to Linneus. This is a fragrant and lovely tree; its smaller branches rather quadrangular, smooth, leafy, lightly scented. Leaves crowded about the ends of the branches, flat, opposite, crossing each other, elliptic-lanceolate, pointed, entire, very smooth, three or four inches long, with one rib, and many fine transverse parallel veins. Foliage channelled, half an inch long. Flowers four or five, red, forming a sort of terminal, simple umbel, whose flals are angular, smooth, above an inch long. The berry has a coriaceous coat, enclosing a very yellow slimy pulp, in which are lodged the partil-coloured seeds. The latter are said to be a favourite food of parrots.

Such is the plant of Dalberg, preferred in the Linnean herbarium. Neither him, nor the original species of Aublet agrees with it as to inflorescence. But his four representations of the fruitification, fig. a to j, undoubtedly agree with the Linnaean specimem, and are of the same sort; while his fig. k to z, represented larger, though described smaller, are certainly very different, particularly the fruit. Aublet appears to have conceived two different sorts of fruits, as well as the trees he describes yield a resin, which serves the natives of Guiana as a strong and useful cement.

SYMPHONIACA, a name given by some authors to the common bayberry or herbane.

SYMPHONIACO STILIO. See STILIO.

SYMPHONIALE, in the Italian Muysc, is sometimes prefixed to a canon, or fugue, to shew that it is at mid-mass. In. i. the that the second part is to follow, or imitate the first is the same intervals, founds, notes, &c., the third to observe the same with regard to the second, and so on.

SYMPHONY, the name of a musical instrument often mentioned in the Fabliaux and old French poetry. It is sometimes called Chiphonie, sometimes Cicëne, but more frequently Sympoïne. Some of the quotations given by Du-Cange describe it as a wind-instrument, and others as a species of drum, pierced with holes like a siffle.

"Je fai jugler de vielle; Je fai de mufe et de fafielle, Et de harpe et de chiphonie. De la gigue, de l'harmonie."

Here are seven instruments mentioned in the compass of four lines.

"All the minfrel art I know, On the vielle I well can play; I the pipe and lynx blow, Harp and jeg my hand obeys, Paltry, symphony, and note."

Zarlino speaks of a Tuscan instrument, which he says was very ancient, and which was called Singonie. According to his description, it was a kind of cithar, upon which the strings were tuned, 4th, 5th, and 8th. The three strings were perpetually foundning in the bafe, while an air was played on the most acute string.

Zarlino adds, that some authors, among whom was Otto-marus Licinius, imagine that this instrument was the tre
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ancient lyre, and probably that of which Horace speaks in the "Ars Poetica."

"Ut gratas inter menas symphonia dics or."%

It should seem from Zarlino's account of this instrument, that he was persuaded the ancients had harmony, or music in parts, and such instruments as he has described.

It is not easy to conceive how this instrument was tuned: for if the 4th and 5th were diatonic close to each other, when struck together, they would produce the harsh discord of the tone major. Perhaps Zarlino means to say that the fourth strings were tuned in the following manner: the first, or highest string C, the second G, the fourth below, the third C, the fifth below G, and octave to the first C, and the fourth C, double octave below the first. But to play an air upon the first string, implies a neck to the lyre, of which we are acquainted with no instance.

The instrument called symphony is mentioned in Daniel, ch. iii. 5, 7. If it was in the shape of a longish chest, or a trigon, strung at the top and played with little ivory rods, as some imagine, we think it more resembles the modern dulcimer than any instrument in present use.

SYMPHONY, Σωμφορία, formed from σωμφος, proper denotes a coinage, or concert of several sounds agreeable to the ear; whether they be vocal or instrumental, or both; called also harmony; which see.

Some authors refrain symphony to the sole mode of instruments: in this sense, say they, the recitatives in such an opera were intolerable, but the symphonies excellent.

The symphony of the ancients went no farther than to two or more voices or instruments set to unison; for they had no such thing as music in parts; as is very well proved by M. Perrault: at least, if ever they knew such a thing, it must be allowed to have been early lost.

It is to Guido Arsenties, about the year 1022, that most writers agree in ascribing the invention of composition; it was he, they say, who first joined in one harmony several distinct melodies; and brought it even to the length of four parts, vis. bass, tenor, counter-tenor, and treble. But there is nothing, says the ingenious Dr. Burney, more difficult than to fix such an invention as this upon any individual; an art utterly incapable of being brought to any degree of perfection, but by a slow and gradual improvement; and the successive efforts of ingenious men during several centuries, must have been trivial and inconceivable in its infancy; and the first attempt at its use necessarily circumcribed and clumsy. This excellent writer has impartially examined and rectified the evidence for and against the antiquity of harmony or counterpoint; and, after an elaborate detail, expressed his own opinion against it; and he has also given a lift and analysis of the writings of Guido, in order to ascertain how much modern music has been indebted to this celebrated monk of Arezzo. Hift. Music, vol. i. p. 112, &c. vol. ii. p. 72, &c.

The word symphony is now applied to instrumental music, both that of pieces designed only for instruments, as sonatas and concertos, and that in which the instruments are accompanied with the voice, as in operas, &c. A piece is said to be in grand symphony, when, beside the base and treble, it has also two other instrumental parts, vis. tenor and fifth of the violin.

Before the above was written, symphony had been highly cultivated in Germany, particularly at the Hanover school, by Stamitz, Holtzbruner, Canabich, Toetschi, and Filtz; by Vanhal, Ditters, and Kozeluch, at Vienna; and since that period, the symphonies of the immortal Haydn have exceeded in number and excellence all that modern times can boast; and seem to include every perfection that can render instrumental music interesting and sublime: invention, science, knowledge of instruments, majesty, fire, grace, and pathos by turns, with new modulation, and new harmonies, without cruelty or affectation. All these excellencies the admirable Mozart had nearly attained; and perhaps he is only inferior to Haydn in the number of his symphonies, from the circumstances of his vital count. Beethoven (pronounced Beethoven), a disciple of Mozart, is now (1804) so rapidly advancing into fame, that there would be little risk in predicting, that, if he lives, he will be the great man among musicians of the present century, as Haydn and Mozart were of the latter end of the last. He is said to be a young man; but writes with the freedom and boldness of long experience, and a fertility of invention that promises inexhaustible resources.

SYMPHORICARPOS, in Botany, is a genus founded by Dillenius, in his Hortus Elthemenis, 371. t. 278, and named by him from Σωμφορίας, to clumber, or accumulate, and κάστρον, frut, alluding to its copiously clustered berries. Jullien has retained this genus, Gen. 211, with some others, which, like it, have been reduced by Linnaeus to Lonicera. (See that article). Dillenius perceived the resemblance of its foliage to that tribe of Honeysuckles called Chaemerae; but seems to have had no idea of any affinity to them in its fructification, which he compares to Cynarita. We may remark that the Chaemerae connect Symphoricarpos with the genuine Honeysuckles, (Castrifusus and Parthenocerus,) however unlike, at first fight, the two extremes may be. They, like their relation Diervilla, are all easily kept separate by artificial characters; but the question is, whether they all together constitute a natural genus, or a section of a natural order, into which section Jullien has well introduced Linnea and Triofeleum, though he has now wisely removed Oenula from hence to his Vitaceae.

SYMPHYSIS, in Anatomy, a general term for those concretions of bones, in which they are immediately joined together, without forming a moveable joint. See Joints.


Gen. Ch. Cal. Perianth inferior, permanent, ere, five, five-edged, cloven into five, acute segments. Cor. of one petal, bell-shaped. Tube very short. Limb tubular, ventricose, a little thicker than the tube; mouth five-toothed, obtuse, reflexed; throat fuscous by five lanceolate rays, shorter than the limb, converging into a cone. Stam. Filaments five, awl-shaped, alternating with the rays of the throat; anthers acute, ere, concealed. Fil. Germens superior, four; syle thread-shaped, the length of the corolla; stigma simple. Peric. none, except the enlarged, widened calyx. Seeds four, gibbous, pointed, converging at the tips.


SYMPHONY

Engl. Bot. t. 817. Curt. Lond. fasc. 4. t. 18. Woodv. Suppl. t. 215. Pl. Dan. t. 664. — Leaves ovate-lanceolate, decurrent. — Found on the banks of rivers and ditches, flowering in May and June. — Stem perennial, flaxey, mucilaginous; black externally. Stem two or three feet high, erect, leafe, winged, hispid with deflexed hairs. Leaves rough, decurrent; the radial ones stalked, broader. Clusters in pairs, hispid, dichotomous at the base. Flowers yellowish-white. — There is a variety of this species with red or purple flowers.

"Comfrey root abounds in a pure, tafteleaf mucilage, like that of the Marsh-Mallow; and being (as Woodville observes) more easily obtained, it ought not to be omitted in lists of medicinal plants. Such medicines are useful in irritations of the throat, inflamations, and, above all, the bladder." — 2. S. tuberosum. Tuberous-rooted Comfrey. Linn. Sp. Pl. 195. Engl. Bot. t. 1523. Jacq. Auct. t. 225. — Leaves ovate, slightly decurrent; the upper ones opposite. — A native of Germany and of Scotland, in moist, shady places, though by no means a common plant. It flowers in July. — Stem perennial, tuberosous; white externally. Stem a foot high, scarcely winged, rough, with deflexed hairs. Leaves ovate, on winged stalks, which are a little decurrent. Clusters in pairs, terminal. Flowers few, yellowish or greenish-white, cylindrical.

3. S. orientale. Evers. Comfrey. Linn. Sp. Pl. 195. (S. confantinopolitanum boraginis folio et facie, flore albo; Buxb. Cent. 5. 46. t. 68.) — Leaves ovate, slightly stalked. — Native of Turkey, on borders of rivulets; flowering from May to July. — Stem perennial. Stems about two feet high. Leaves ovate, rather broad, armed with rough, prickly hairs. Flowers clustered as in the foregoing species, of a blue colour.

4. S. asperum. Prickly Comfrey. Ait. Hort. Kew. n. 4. Sims in Curt. Mag. t. 929. — Stems prickly. Leaves oval, acute, stalked, the floral ones opposite. Clusters in pairs. — Native of Caucasus, flowering through the summer. — "This species (says Dr. Sims) is by far the largest of the genus, growing to the height of five feet, and is really an ornamental, hardy perennial, which will thrive in any soil or situation." — Stem upright, rather wavy, covered with curved prickles. Leaves large, dark green. Flowers in drooping clusters, of a rich blue; the buds of a deep crimson.

SYMPHYNUM, in Gardening, contains plants of the hardy, herbaceous, perennial kind of which the species cultivate are; the common comfrey (S. officinale); the tuberous-rooted comfrey (S. tuberosum); and the Oriental comfrey (S. orientale). In the first sort there are varieties with white flowers, purple flowers, with blue flowers, and with red flowers.

Method of Culture. — These plants may be increased by seeds or parting the roots, but the latter is more practicable. The seeds should be sown in the spring, in a border of common earth; in the autumn the plants will be proper to set out where they are to remain, or to remove into other pots. The roots should be parted in the autumn, and planted out either in beds about a foot from plant to plant, or where they are to remain; almost every part will grow, and the plants are hardy, and succeed in any soil or situation; they only require to be kept clean afterwards. They produce variety in mixture in the borders and other parts of ornamental grounds.

SYMPLEXIUM, in Natural History, the name of a genus of foills, of the class of the seleritaceae, but not of the subclass of regular figure of most of the genera of those bodies, but composed of various irregular connections of differently shaped, and usuflally imperfect bodies. The different bodies that form this kind are seldom quite perfect, having usually fallen together before they were wholly hardened; but generally, whether they form a larger or smaller mass, they together affect the external figure of a flat column, though variously notched at the sides, and truncated at the ends. Hill.


Gen. Ch. Cul. Perianth superior, bell-shaped, in deep, roundish-ovate, concave, permanent segments, as if of one petal, bell-shaped, longer than the calyx, composed of from five to ten ovate, entire, reflexed segments, or petals, united by their claws into a tube the length of the calyx, and all falling off together. Stem. Filaments numerous, linear, flat, erect, attached to the tube of the corolla in several imbricated rows, and combined equally at their base into one set; anthers roundish, two-celled, erect. Pist. German inferior, truncate; style thick, the length of the filaments; stigma capitate, distinctly five-lobed. Pericarp elliptic-oblong, dry, one cell, crowned with the calyx. Seed. Nut of the same form, striated, of from three to five cells, with an oblong cylindrical kernel in each.

Eff. Ch. Calyx superior, in five deep segments. Petals five to ten, united at the base. Stamens in several rows, inserted into the corolla. Drupa dry. Nut of from three to five cells.

1. S. martincinaco. Martincio Symposcos. Linn. Sp. Pl. 747. Willd. n. 5. Jacq. Amer. 185. t. 175. f. 6. Swartz Obs. 293. t. 7. f. 1. — Stalks somewhat racemose. Leaves crenate, very smooth on both sides. — Found in the woods of the island of Martinico, flowering November. A branching tree, twenty feet high. Leaves scattered, stalked, ovate, acute, two or three inches long, shining, somewhat coriaceous. Flowers stalked, stiltie, solitary or slightly racemose, white, smelling like hawthorn, and about the same size.

2. S. Cipinoma. Guiana Symposcos. Willd. n. 2. (Cipinoma guianensis; Aubl. Guiana, 567. t. 276. Ceva Diff. 271. t. 217.) — Stalks many-flowered, the length of the footstalks. Leaves nearly entire; villous at the back. — Native of woods and waste ground in Guiana, bearing flowers and fruit in September. A middle-sized tree; trunk seven feet high, and seven inches in diameter, with grey bark. Leaves stalked, about three inches long, elliptical, pointed; smooth above; clothed when young, as well as the branches, with flesh-coloured hairs. Flowers little axillary tufts; their corolla white, edged with yellow.

SYM

flowered. Leaves ferrated, nearly naked."—Gathered by
Dombey in the woods of Peru. L’Heritier considered this
as intermediate between the two former, and supposed they
might all possibly be varieties of one species.

Occ. 1837. Wild. t. 14.—Petalas eight, slightly connexed.
Stalks single-ferrated. Leaves finely ferrated, smooth on
both sides. — Native of lofty mountains, in the south
part of Jamaica, flowering in July and August. A tree
20 to 30 feet high, with smooth brittle branches. Leaves
bright green, broader than in the first species. Flowers
about the size of a lemon-blossom, white, fragrant, with a
very short tube, and always eight divisions. Fruit the size of a
filbert. Swarts.

Wild. n. 5. Alt. n. 1. (Hopea tinctoria; Linn. Mant.
195. Pursh 451. Arbor laurifolia, floribus ex foliorum
alis; Catechu. Carol. v. 1. 544, with a plate.) — Flowers
nearly sessile, axillary, crowded. Leaves slightly ferrated,
rather glaucous. In the low woods of Virginia and Caro-
olina, flowering in April and May, when its scent is very
agreeable. Dr. Garden sent it to Linneus, and called it
Hopea, after Dr. Hope, professor at Edinburgh. (See our
Hopea.) We believe it was also sent alive to Dr. Fothergill
by the same person. This is a shrub or small tree. The
trees are oblong-lanceolate, occasionally downy beneath,
have a sweet taste, and dye a fine yellow. Flowers yellow,
small, very fragrant.

Wild. n. 6. (Allontia theciformis; Linn. Suppl.
264.)—Petals about ten, slightly connexed. Flowers axi-
illary, sessile, about three together. Leaves elliptical, ob-
tuse, slightly ferrated, smooth. — Gathered by Mutis in
New Granada. A smooth rigid shrub, with coriaceous,
veiny, shining leaves, hardly an inch and half long, on
short thick stalks. Flowers white, nearly the size of a
hawthorn. The younger Linneus thought the leaves tasted
like tea, and might serve as a substitute for that plant, but
they would be even more out of our reach. It is singular
that the genera dedicated to two Edinburgh professors,
should thus coalesce under another previously established.

SYMPOSIAC, συμποσιακός, formed from συμποσίω, feast; a conference or conversion of philosophers at a
banquet.

STANDARD, which has nine books, which he calls Symposiacs; or
symposiac questions, q. d. disputations at table.

SYMPOSIARCH, συμποσιαρχός, in Antiquity, the direc-
tor, or manager of an entertainment. This office was some-
times performed by the peron at whose charge the enter-
tainment was provided; sometimes by another, named by
him; and at other times, especially in entertainments pro-
vided at the common expense, he was elected by lot, or
by the suffrages of the guests. He was otherwise called
Bacchus, rex, and moderator, &c. he determined the laws
of good fellowship, and observed whether every man drank
his proportion, whence he was called opisthaleus, occator, the
eye.

SYMPTOM, in medicine, denotes any change in the
body, or its functions, perceptible either to an observer, or
to the patient himself, which indicates disease. On some
occasions, the diseased condition may itself come under the
consciousness of our senses, as when an external part has re-
ceived a mechanical injury. But in the great majority of
cases, the essential natural state, or that which constitutes
the disease, is concealed from our immediate view, and its
existence can be inferred only from the observation of some
of the remote effects which it has produced, either on the
appearance and external qualities of some parts of the body,
or on the condition of some of its functions; among which
must be comprehended the disordered sensations which the pa-
tient may experience. They are the observable effects, that
are properly the symptoms of a disease; they are the signs
or indications of the existence of a certain morbid condition,
of which they are the usual concomitants; and their affirma-
blage constitutes a fort of language, which it is the business
of the physician to understand and interpret.

It is in this interpretation of the phenomena, that the
chief application of science consists, as is indeed the case
in all the departments of human knowledge; but in medi-
cine, our reasonings in regard to the series of changes
which have preceded the observed effects, are liable to a
peculiar source of fallacy, from the disordered nature of
the phenomena on which they must be founded. The
more important internal changes are removed from our
view, and all that we are admitted to view, in the course
of a disease, is a certain number of symptoms, which are
generally not the immediate result of the primary, or, as it
has been termed, the proximate cause. A long and laborio-
ous induction is, therefore, required to enable us to trace
the intervening steps which connect the appearances together,and
assign to each its proper rank. The infensibility of
many organs, even of those connected in the with the
symptoms which prevail between contiguous and dif-
tant parts; the subtle organisation and obscure nature of the
functions of others, introduce much ambiguity in a variety
of cafes. But in the determination of diseases, we gen-
erally derive much more assistance from the presence of par-
ticular symptoms, which are observed more uniformly to
accompany a certain morbid condition, than we do from
that of others, which are not so constantly met with in con-
junction with, or which may exist totally independent of,
such a state. The former are the characteristic symptoms
of the disease; or, as they have been termed, the patho-
nomonic or diagnostic symptoms; being those on which
reliance is to be placed in establishing the diagnosis:
the latter are more accidental, and contribute less directly
to the same object; or may, in other cases, be altogether dis-fis-
regarded, as of no value in the solution of the problem.
Many symptoms of this latter class, on the other hand,
which are but remotely connected with the primary morbid
affection, are the source of much suffering to the patient,
and their removal or palliation is an important object in the
treatment. It is, however, a common error of superficial
reasoners, to suffer their attention to be so wholly engrossed
by the consideration of some predominant symptom, as to
overlook the remote source of the disease, and to limit their
efforts to the relief of the one, without providing for the
cure of the other. This may happen even when the symp-
tom in question is essential to the disease, as is strongly ex-
emplified in enteritis, where the removal of pain and con-
stitution of the bowels, which are the most prominent symp-
toms of that disease, is sometimes injudiciously considered
as the leading indication, to the neglect of remedies cal-
culated to remove the inflammation, from which these
symptoms have in fact originated; and which, if suffered to
continue, would reproduce them in an aggravated degree,
even had we succeeded in obtaining a temporary alleviation.
See ENTRITAS.

A general classification of the symptoms of diseases, and
a review of the principal kinds, has been already given
under the article DIÁBÁSIS.

SYMPTOMATIC is a term applied to diseases, which
are the consequences of some prior disorder in some other
part of the body. It is opposed to idiosyncratic, which see.
SYMPTOMATICAL Classification of Diseases. See Nosology.

SYNÆRESIS, συναρέσις, contraction, in Grammar, a figure, by which two syllables are united in one. As compare Government. See CONTRACTION.

SYNAGOGUE, συναγωγή, literally importing family, congress; a particular assembly of Jews, met to perform the office of their religion. Allo the place in which they meet.

The Jews used the term in the primary sense, when they speak of the great synagogue; meaning the court of the seventy elders, which they pretend to have been intituted originally by Moses, and the members of which they afterwards increased to one hundred and twenty. See SANHEDRIN.

Some authors take the use of synagogues to be of no old standing among the Jews; and maintain, that it was not till after their return from the Babylonish captivity, that the opinion first prevailed, that the worship of God was not to be restrained to the temple at Jerusalem, that it could not be held any where else. The consequence of which new opinion was, that the Jews began to build for themselves synagogues in all their cities.

Others hold that there were synagogues even in the time of David, and that they were as ancient as the ceremonial law (see Levit. xxii. 3. 4. Deut. xxxi. 11, 12. P. ixxiv. 4. 8.) but be this as it will, no assemblies of the Jews appear to have been called synagogues till a little before the coming of Jesus Christ, who is said to have preached in the middle of the synagogue. That they had been in use before this time, is evident from the declaration of St. James (Acts xv. 21.) "Moses of old time hath in every city them that preach him, being read in the synagogues every sabbath-day."

The synagogues were used, not only for divine service, but for holding courts of justice, especially upon ecclesiastical affairs. To this use of synagogues, some have supposed that St. James refers, ch. ii. 2—4.

The Jews erected synagogues not only in towns and cities, but also in the country, especially near rivers, for the convenience of obtaining water for washing and purifying.

They were not allowed to build any synagogue in a town, unless there were in it ten persons of piety; i.e. as the Talmudists have interpreted this phrase, ten persons of learning and approved integrity, free from all worldly occupations, and disengaged from all civil affairs, who were maintained and hired by the public, that they might always resort first to the synagogue, so that whoever came in might find ten persons there; which number was necessary, as the Jews thought, to make a congregation. When a synagogue was built, it was consecrated by prayer, without much ceremony or formality; and it was regarded as a sacred place, which was carefully guarded from profanation. There might be several synagogues in the same city; and as the Jews say, they had 480 in Jerusalem. The most famous synagogue the Jews had, was the great synagogue of Alexandria, of which the rabbins say, that he who hath not seen it, hath not seen the glory of Israel.

The chief things belonging to a synagogue were the ark or chest, in which was deposited the book of the law, i.e. the pentateuch; the pulpit, with a desk in the middle of the synagogue, in which stood up the person who was to read or expound the law; the seats or pews in which the people sat for hearing the reading and exposition of the law; of which seats some were more honourable than the others, those of the elders being called in the gospels the "chief seats," (Matt. xxiii. 6.) the women sitting by themselves in a kind of balcony or gallery; the lamps that were fixed in the walls, or hung to the ceilings, and the rooms or apartments in which the utensils belonging to the synagogue were kept.

For the regulation of the synagogue service, there was a council or assembly of wise and grave persons, well versed in the law, over whom was appointed a president, who was called the "ruler of the synagogue," a name which was sometimes given to all the members of this assembly, (Mark. v. 35. &c. Luke, xiii. 41.) The business of these persons was to order every thing belonging to the synagogue, and also to teach the people. The government which they exercised in the synagogue consisted of several particulars: they punished the disobedient and refractory cenfures, excommunication, fines, and scourging; they took care of the alms, called by the sacred writers, as well as the rabbins, "righteousness," (Matt. ix. 18. Mark. v. 36. Acts, xvii. 8. iv. 5.) and the chief ruler, or one of the rulers, gave leave to have the law read and expounded, and appointed the person who should do it. In the ancient synagogue, as it was first established by Ezra, the priests and Levites delivered their discourses for the purpose of facilitating the understanding of the text of the sacred writings. And in our Saviour's time, the duty of preaching and of permitting others to do it, belonged to the ruler of the synagogue. (Acts, xiii. 15.) Some persons have expressed their surprise, that our Saviour and his disciples should obtain the permission of the president, or ruler, to preach in the synagogues; but it should be considered, that they were Jews, and strict observers of the law; that they were well versed in it and even in the rabbins and doctors, (Acts, xiii. 1. Matt. xxvii. 55. Acts, xiii. 14. 1 Cor. iv. 30.) and moreover, that if they had not been doctors, they might have claimed this privilege, as persons of gravity, learning, and unblamable conduct.

In every synagogue there were several ministers, to whom different employments were assigned; one, called the "advocator, or angel of the synagogue," (theiach siebhor) the rood before the ark in which the seriptures were kept, and repeated the prayer "Cadich," before and after reading the law; another, called "minister of the synagogue" who, from the pulpit, gave notice to the Levites when they were to found the trumpet; this minister sometimes read the law; and another minister, called "guardian or keeper" (chafan,) whose business it was to take the book of the law out of the chest, to give it to the reader, and to lay it up again; to call out to him that was to read the lesson out of the law or the prophets, to stand near him, and to correct him if he read amiss; to blow the trumpet, and thus give notice of the sabbath, of the beginning of the new year, to publish an excommunication, &c.; to inform the people when they should say "Amen," after the prayer repeated by the angel of the synagogue before and after the reading of the law; and to take care of the synagogue, and of its utensils.

The service of the synagogue was performed three times in a day, viz. in the morning, in the afternoon, and at night.

In the morning service, before the public prayers by the angel of the synagogue commenced, the people repeated several private prayers, viz. 19, of considerable length. When they were ended, the minister, public prayers, the people likewise standing, and bowing the knee and body at the rehearsal of some particular passages; and their service began and ended with the prayer "Cadich," similar to our Lord's prayer. When prayers were ended,
SYN

the chafan took out of the chest the book of the law, upon
which the whole congregation shouted, and expressed great
joy. This book consisted of several large volumes or rolls of
vellum, filled or glued very neatly together, and fastened
at one end to sticks very nicely turned. For an account of
the manner of reading the pentateuch, see PENTATEUCH
and PARASHU. After the section for the day, which
was subdivided into seven parts for so many readers, was
read and deposited by the chafan in the chest, the next part
of the service was some thanksgiving or doxology, ending
always with the prayer Cadimah. After the reading of the
law or pentateuch, which was read over once every year, there
followed that of the prophets, before which they read some
passages out of the writings of Moses. On Mondays and
Thurdays they read only the law; but on the sabbath, as
well as on fast-days and festivals, they read the prophets, and
only in the morning; for in the afternoon they constantly
read only the law. The books which the Jews meant by
the prophets were those of Joshua, Judges, Samuel, Kings,
and Chronicles, which they supposed to have been written
by prophets, denominated the "former prophets;" and they
referred to the second class Hiaiah, Jeremiah, and Ezekiel,
with the 12 lefher prophets, all of whom they called the "latter prophets." Daniel was not included among the
prophets. Accordingly, by the law and the prophets,
mentioned in the New Testament, we are to understand the
five books of Moses, and the prophetic writings above
mentioned. The same ceremonies occurred before and after
the reading of the prophets as at the reading of the law,
except that there were some additional thanksgivings then
repeated. Portions of the prophetic writings were selected,
which portions had a relation to what had been previously
read out of the law.

After the Hebrew language ceased to be the mother-
tongue of the Jews, the holy scriptures were from that
time interpreted in their synagogues, either in Greek or
Chaldee; and this practice gave rise to the Chaldean
paraphrases now extant. Some suppose that this cus-
tom was established by Ezra; others, with greater probabil-
ity, fix the commencement of it to the time of the Mac-
cabees. The mode of interpreting was as follows: the
minister, or any person appointed to read, read one
verse in the original Hebrew, if it was out of the law, and
three verses, when it was out of the prophets; then the in-
terpreter rendered the whole in the vulgar tongue. The
interpreter was esteemed by the Jews less honourable than
the reader, from respect to the original text; and very
young persons were admitted into this office. Some pas-
sages it was not lawful to interpret: such were the incest
of Reuben, of Thamar, and Amnon, the bleeding which used
be given by the priest (Num. xi. 23—26.), and the lat-
ter part of the history of the golden calf (Exod. xxil.
31—35.) The reading of the prophets, according to the
rabbins, was closed with the priest's bleeding; after which
the congregation was dismissed, unless somebody was ap-
pointed to preach.

The afternoon service consisted in singing the 8th
psalm, from v. 5, to the end, and the whole 145th, in
rehearsing the prayer Cadimah; in saying first in a low
voice, and afterwards aloud, one of the prayers that had
been said in the morning, with several other prayers and
thanksgivings; and in repeating the prayer Cadimah, which
concluded the service.

The evening service was almost the same. One of the
principal ceremonies performed in the synagogue was cir-
cumcision; though this was performed sometimes in private
houses.

There are synagogues in all the principal towns in Europe,
where Jews reside.

SYNAGRIS, in Ichthyology, a fish caught in the Archi-
pelago, and some other seas, and much resembling the
dentex. Some have used it as a synonym for that fish, and
others accounted it only a name applied to the dentex while
young; but it is properly a distinct species.

According to Arctedi, it is a species of the sparus, and is
distinguished by him by the name of the variegated sparus
with a sharp back, and with four large teeth. Linnaeus also
makes it a species of sparus; which see.

SYNALOEOPHA, ουσιναεπά, from συν, together, and λεοπά, I
aimus, in Grammar, a contraction of syllables, performed
principally by suppressing some vowel or diphthong at the
end of a word, on account of another vowel or diphthong at
the beginning of the next. As ill' ego, for ill' epo, &c.

"Conticuer omnes intensi' ora tenebant." Virg.

It is called by the Latins collisia.

SYNANCHE, in Medicine. See SYNANCHE.

SYNAPHE, in the Ancient Greek Muse, the conjunc-
tion of two tetrachords, or more exactly, the union of two
conjoint tetrachords, by the last found of the one being
the first of another. There are, therefore, three synaphes in
the Greek system: one between the hypate tetrachord and
that of the mefe; the other between the mefe tetrachord and
that of the fysmenwmen; and the third between the disjunct
chords and that of the hyperboleon. See SYSTEM and
TETRACHORD.

SYNAPHEA, in Botany, so named by Mr. Brown, from συναφή, a conuision or cohesion, on account of the peculiar
union of the stigma to one of the filaments which bears
no anther.—Brown Tr. of Linn. Soc. v. 10. 155. Prodr.
Nov. Holl. v. i. 360. Bot. of Terra Austr. 14.—Clais and
Brown.

Gen. Ch. Cal. none, unless the corolla be so denominated.
Cor. of one petal, ringent, deeply four-cleft, and at length
splitting into four parts; tube swelled; upper lip con-
cave, undivided; lower in three acute spreading segments,
the middle one smallest. Stam. Filaments four, inserted
into the tube of the corolla, and concealed within it; the
uppermost abortive, its point connected with the stigma; two
lateral ones bent forward at an acute angle; lowermost
broader, erect; anthers oblong, of one cell, two situated
back to back on the lowermost filament, one on each of the
lateral filaments, combined with the others laterally before
they burst, so that each pair forms in appearance but one
anther, bursting at the point of connection. Pfil. German
superior, inversely conical, brilly at the summit, without
any glands at the base; style club-shaped, curved, smooth,
deciduous; stigma dilated, oblique, crowned with one or
two erect horns, and strongly united behind to the abortive
filament. Seed. Nut solitary, obovate, fringed at the upper
dge with numerous spreading bristles, about its own
length.

Eff. Ch. Calyx none. Corolla four-cleft, ringent, bear-
ing the flaments. Anthers two on the lower filament.
Upper filament abortive, combined with the stigma. Nut
crownd with bristles.

This genus is separated by Mr. Brown from CONOPE:
MUM, (see that article,) chiefly on account of the very ex-
traordinary connection between the stigma, and the upper-
most filament, which is imperfect, bearing no anther. His
ideas of the flaments, in both genera, differ from ours;
but the subject is obscure, and we are guided by the analogy
of other plants in the same natural order, to consider the
authors
SYNTHROUSMUS, synarthroseus, in Rhetus, a figure which, in order to magnify a thing, whether good or bad, enumerates a great many different perfections, absurdly, so to which it relates: thus Cicero, "qui mihi venturum quod fumus, me fratri amantissimo, liberis nostris parentes, soci liberos; qui dignitatem, qui ordinem, qui fortunas, qui amplissimam rem publicam, qui patriam, qui nihil poterit e jucundius; qui denique nonmet ipnos nobis reddita." See Volf. Rhet. lib. v. p. 372.

SYNARTHROSIUS, in Anatomy, that kind of union of bones, in which no motion takes place.

SYNAULIA, the union of many musicians, who in the ancient music played on flutes in the antepalonal manner, answering each other alternately, without any mixture of voices. Rouleau observes that Malcolm, who decided whether the ancients had any music composed expressly for instruments, yet has circumcised Athenæus this account of the synaulia. He is, however, right in his first opinion: for these synaulia were nothing more than vocal music played by instruments, in a concert of unisons and octaves.

SYNEBRANCHUS, in Ichthyology, a genus of fish of the order Apodes, established by naturalists since the time of Linnaeus. The body is cell-shaped, it has no pectoral fin, and the spiracle is single beneath the neck. This genus differs from the Muraena, which feeds, in the circumstance of the spiracles or branchial orifice being single, and situated beneath the throat. There are but two species.

MARMORATUS; Olive-brown Synbranchus, marked with blackish spots; the body is yellowish beneath. The general species of this animal is that of a murrena: is about 30 inches long; the head is large, short, and thick; mouth moderately wide, and furnished with several rows of small conical teeth; the tongue is connate; lips fleshy, maxillaries simple, seated near the eyes, which are blue; the base of the body is thick and loofe; the back is of a deep ochre colour, with dusky spots; the belly and flanks are of a yellowish cast, and the spots on those parts have a tinge of violet. The dorsal or rather the caudal fin is extremely remote from the head, and surrounding the tail, unites with the vent-fin; the vent being situated at the distance of five inches from the end of the tail, which terminates acutely. It is a native of the fresh waters of Surinam.

IMMACULATUS. This is of a plain unvariegated colour: it is much allied in general form to the preceding, but is considerably smaller, and very different in colour, being nearly of a uniform brown throughout, with the exception of a few very obscure sub-tranverse dusky bars across the body, and a few whitish marblings on the fins. This, like the former, is a native of Surinam.

Dr. Shaw has mentioned another genus, denominated Spagerrachthus, which is so much allied to the latter noticed, that it may be described in this place. It has an cell-shaped body, and no pectoral fins: it has two spiracles beneath the neck.

ROSTRATUS, with the upper lip produced into a nose. This fish, as described by Dr. Bloch, measures about six inches, and is of a cylindrical form: it is situate both on the sides of the upper jaw is considerably longer than the lower, being indeed sharpened into a point: the eye is small; the teeth numerous; and the two spiracles or branchial orifices are situated at about an inch beyond the mouth, immediately beneath the neck or fore part of the body. The colour they are opposite when only equal in number to their divisions.
SYN

colour of the whole animal is of a pale brown. It is finely
figured in Dr. Shaw’s fourth volume.

SYNBRON, in Geography, a town of Germany, in the
margrave of Anspach; 6 miles S. of Feuchtwang.

SYNCAPE, formed of συν, and κατέβας, bending, a word
used by the old writers to express the joint, or flexure,
where the upper part of the arm is joined to the lower.

SYNCHRONOS, συνήθεια, in Logic, denotes a word which, signifying little or nothing of itself, yet
when joined with others, adds force to them: as all, none;
certain, &c.

SYNCAUSIS, formed of συν, and καυσίς, burning, a word
used by some medical writers to express the drying; and, as
it were, burning up of the excrements with the body by
febrile heat.

SYNCELLUS, or SINCULUS, an ancient officer in the
family of the patriarchs, and other prelates of the eastern
church.

The word in the corrupt Greek, συγκελλας, signifies a
peron who lies in the chamber with another; a chamber-
fellow, or chum.

The synkellos was an ecclesiastic, who lived with the
patriarch of Constantinople, to be a witness of his conduct;
whence it is, that the synkellos was also called the patriarch’s
eye, because his business was to observe and watch.

The other prelates had also their synkelles, who were clerks
living in the houle with them, and even lying in the same
chamber, to be witnesses of the purity of their manners.

Afterwards the office degenerated into a mere dignity;
and there were made synkelles of churches. At last it became
a title of honour, and was bestowed by the emperor on the
prelates themselves; whom they called pontificial synkelles,
and synkelles Augufitales.

There were also synkelles in the western church, particular-
lly in France. The first council of Paris speaks with a
great deal of indignation of some bishops who abolished the
office of synkelles, and lay alone; and strictly enjoins them,
that for the future, to take away all occasion of scandal,
they made the office of synkelles inseparable from that of
bishops.

SYNCELLUS, George, in Biography, a Greek his-
torian and chronicles, derived his name from his being syn-
cellus, or confidant resident with Tarasias, patriarch of Con-
stantinople. He wrote a “Chronography,” in which he
transfers the whole chronicles of Eufebius, subjoining cen-
sure and corrections of that author, though he himself
often errs both in history and chronology. Synkellos
lived in the time of Charlemagne, and began to write his
history in 792, but was prevented by death from extending
it beyond the times of Maximian and Maximin. It was
published in Gr. and Lat. by F. Goar, in 1652, fol. It is
valuable for the account of the Egyptian dynasties.

SYNCHONDROSIS, in Anatomy, the connection of
bones by the intervention of cartilage, as the ossa pubis, the
bodies of the vertebræ, &c.

SYNCHORESIS, συνήθεια, in Rhetoric, the same with
permium.

SYNCHRONISM, συνήθεια, formed of συν, and
χρόνος, time; the being or happening of several things toge-
ther, at or in the same time.

The happening or performing of several things in equal
times, as the vibrations of pendulums, &c. is more properly
called isochronism: though some authors confound the
two.

SYNCHYSIS, συνήθεια, in Rhetoric, a confused manner
of expression, where the natural order of the words is per-
verted. Horace affects it much: thus, lib. i. sat. 5.

“Pane macroดำ uist dum turbos versat igne.”

SYNCHYSIS, in Surgery, a confusion of the humours of
the eye, from blows, or violent inflammation.

SYNCOMISTERIA, συνεμπιστοσύναι, in Antiquity, the same
with thalēss.

SYNCOMISTON, formed of συν, and κατέβας, I nourish,
a name given by Atheneus, and some other authors, to the
coarser sort of bread eaten by the poor in many countries,
and made of unsifted meal, the bran being mixed up among
the rest. This is a very nourishing food, and for laborious
people, or those who use much exercise, is highly preferable
to all other sorts of bread.

SYNCOPE, and SYNCPATION, in Music, the pro-
longing of a note begun on the unaccented part of a bar, to
the accented part of the next bar. Thus every syncopated
note is what the French call contre-temps, against time; and
every succession of syncope is moving against time. It
must be remembered, that though the notes are not tied, if
they are repeated in quick notes on the same line or space,
they are as much syncope in the harmony, as if they were
united by a ligature.

Syncopeation has its use in melody for taste and the expre-
sion of words; but its principal effect is in harmony, for the
 treatment of dissonances. The first part of a syncope serves
as the preparation; the discord is continued on the second
part; and in a succession of discords, the first part of the
following syncope serves as a resolution of one discord, and
the preparation of another. The derivation of the word
syncope, or syncopeation, by Rameau and Rousseau, does
not satisy us: the first thought it came from the shock or
crash of sounds, in the dissonance; and the citizen of Geneva
derived it from συν, and σύστεται, I cut, or beat. But by the
sentation it excites, we rather think it repels in music the
effect of a syncope in medicine, in which faculty the word
implies a swoon, or fainting away.

Syncopeation is used for a driving note, that is, when some
shorter note at the beginning of a bar, or half a bar, is fol-
lowed by two, three, or more longer notes, before any
other occurs equal to that which occasioned the driving
note, to make the number even; when, for example, an odd
crotchet comes before two or three minimi, or an odd quaver
before two or three crotchets, &c.

To describe all the effects of syncopeation in melody, and
all its use in harmony, would require a book, instead of an
article for a dictionary. In quick movements, syncopeation
or driving notes expresses passion and impatience; in slow,
langouer and sorrow, sighs and despair. In harmony, all
regular discords are prepared, struck, and resolved in syn-
copeation. In the 20, the syncope is in the base; in the 4th,
7th, and 9th, in the treble. But in melody, the syn-
cope so much resembles what the French call dissonances,
linking, fainting, and swooning, that it seems to confirm
the etymology to which we incline; as a tone in syncopeation,
hower forcible and loud in the beginning, grows more and
more feeble and faint to the end; particularly on fringed in-
struments incapable of sustaining a sound.

In our Music plates, examples may be observed in the pre-
paration of all regular discords.

SYNCOPE, in Grammar, denotes an ellision, or reten-
chment of one or more letters, or syllables, from a word.

As when we say, virum for viriun, and manem altum suspi-
rum, for repulsium.

SYNCOPE, in Physiology and Medicine, fainting; a con-
side
SYNCOPE.

derable diminution, or complete interruption, of the motion of the heart, and of the function of respiration, accompanied by a suspension of action in the brain, and consequent temporary loss of sensation, volition, and the other faculties of which the brain is the organ. The complaint frequently comes on suddenly; at other times, it is more or less gradual in its approach. The following are the usual signs which indicate an impending attack: a sense of oppression and anxiety about the heart, chilliness, irregular palpitation, pain or sense of palpitations in the stomach, giddiness, feeling in the ears, dimness of sight, in which objects appear as if enveloped in mist, while a number of luminous points, or sometimes flashes of light, overspread the sphere of vision. Palmarının of the countenance, heaviness of the eyes, a general collapse of the features, and flight quivering of the lips, betray to an observer the change that is taking place in the capillary circulation; while at the same time the pulse grows exceedingly feeble, irregular, and for the most part frequent, till it ceases to be perceptible. The respiration, in these changes, becomes weak in proportion as the heart flags, and is discontinued altogether upon its ceasing to act. The blood now retires from the surface of the body, which loses its warmth as well as colour, and either contracts, or, from being moistened with cold perspiration, becomes white as snow. The extremities swell, which is often partial, and breaks out especially on the forehead and back. The functions of the brain are suspended; the patient losing all consciousness, f FaNIFN, and powers of voluntary motion; a general relaxation of the muscles takes place throughout the body; which may extend even to the sphincters, when the fainting is complete, and of long duration. If this state, indeed, should continue for any time, there may be difficulty in distinguishing it from the effects of death; for the body, under these circumstances, soon becomes cold, especially in the extremities. The joints, however, retain their flexibility; and the insensible actions of the capillary vessels, and organic texture of the body continuing to be carried on, life is still preferred, the blood retains its fluidity, and no approach is made towards putrefaction. Influences have occurred of persons continuing in a state of trance, or prolonged syncope, for many days, and yet at length recovering. The recovery from a fainting fit is always gradual, and is generally attended with more uneasy feelings to the patient than those by which it was ushered in. The sensation of anxiety about the heart is often exceedingly distressing; there is usually some nausea, discharge of sputum, and sometimes vomiting; and cold sweat very commonly occurs; together with palpitation, which is frequently violent, and sometimes the paroxysm terminates in convulsions, or an epileptic fit. Slighter attacks of epilepsy, indeed, frequently appear under the form of syncope. Sometimes one fit immediately succeeds another, for six or seven times, before the patient is tolerably recovered. Occasionally it has happened that the suspension of the animal functions has not accompanied, or at least has not been proportioned to that of the vital actions. A remarkable instance of this anomaly occurred in the case of the celebrated Mr. John Hunter, who continued for about three quarters of an hour without any sensible pulsation at the wrist, or any respiration, except what was produced by an effort of the will, while he retained all his powers of sensation, thought, and voluntary motion.

The various degrees in which this affection may occur, have given rise to a number of distinctions among theologians, which do not, however, appear to be founded. The distinction in the nature of the disease. Dr. Cullen has, therefore, with great propriety, placed the lipothymia, aphthysis, and deliquium of former authors, under the head of syncope: but it may, after all, perhaps be doubted, whether fainting, which is so constantly a secondary affection, arising from other disordered states of the system, should not rather rank as a symptom than as a distinct disease. We find it taking place from a variety of causes, some of an exciting, and others of a depressant nature. It is a symptom familiar to hypochondria and hybernic persons, and may be brought on in all those who have much mobility of nerves, by any sudden or violent emotion, passion, or even strong sensation. It is a very usual concomitance of violent pain, such as that which accompanies a surgical operation. Women are more prone to syncope than men, in consequence of greater mobility, and of greater susceptibility to impressions made on the nervous system. But we find, even among men, frequent peculiarities of constitution, which a spirit of general strength of frame, disposes them to fall from causes which appear slight, and would be inadequate to produce any effect of the kind in others. The light of blood, of a wound or sore, certain odours, or the presence of objects, such as a cat, a mouse, or a spider, in which a person has conceived an unaccountable aversion, may give rise to every degree of this affection. The ease is sometimes so great that it occurs with the sight, and at the recollection of the object to which it is referred, or even the sound of it. The removal of fluids which have collected in any part of the body, such as the hydroptic water in ascites, or the matter of a large abscess, is often followed by fainting. Cases which suddenly diminish the supply of blood to the brain tend peculiarly to produce it in those who are disposed to: this sometimes happens in consequence of remaining too long in the erect posture; or still more from rising suddenly from the horizontal position, and stretching out the arms towards an object placed above the head, as in reaching a book from a high shelf in a library. Syncope sometimes marks the termination of acute disorders, such as fever, hooping-cough, the influenza, or the exanthemata: it prevails frequently during the period of pregnancy: and is sometimes induced by alarming degrees of severe heat.

In other cases it is a symptom of some mechanical obstruction to the circulation, from organic affections of the heart itself, or the large vessels in vicinity. See CARDIOGOMUS.

This latter class of cases has been distinguished by Dr. Cullen as a distinct species, under the title of SYNCOPE CARDAINE, while the rest are included under the general head of SYNCOPE OCCASIONALE.

The pathology of syncope must depend upon the nature of the remote cause by which it has been induced. We have already endeavoured, under the article HEART, to show how it begins with an affection of the brain, and must refer our readers to what has there been said, for information on this part of the subject.

The recovery of the patient from the actual fit is, in general, easily effected by merely placing him in a horizontal position, dashing cold water on the face and hands, or clashing the temples with stimulant ammoniacal liquids, which may also be held to the nostrils when the breathing is not easily sustained. If the fit were to continue, however, it would be proper to rub the body with hot clothes, to administer Clysters, and to employ, in a word, all the aids
mean which are found expeditiously in the recovery of drowned persons. The nature of the preventive treatment must depend on that of the cause that keeps up the tendency to the complaint. A recurrence of the exciting causes should be guarded against, while the general habit is strengthened, and the mobility of the nervous system counteracted by appropriate means. Dr. Heberden observes, that when the disorder is habitual, and not complicated with any other, he has found cold bathing to be beneficial. All evacuations, especially bleeding, are manifestly hurtful to those who are subject to fainting. It should, however, be borne in mind, that frequent fainting, especially if it be found to occur certain periods, or to occur more particularly upon waking in the morning, is a very usual mode in which epilepsy commences; and when this may be insuperable, no time should be lost in applying the remedies called for by that disease.

SYNCRETISTS, formed of συνεργείον, I work together, or συνεργείον, denote in general persons who, from a variety of discordant opinions, either in philosophy or religion, form a kind of comprehensive and pacific system, with the view of uniting the several parties who maintain such opinions. The moderate men, as they are called, of every persuasion, may be comprehended under this denomination. The Platonic Syncretists, towards the close of the fifteenth century, were of this class; for they considered Plato as the supreme oracle of philosophy, and yet would by no means suffer Aristotle to be treated with indifferency or contempt; and they proposed to place, as the jarring deductions of these two famous Grecian fages, and to combine them into one system. These moderate philosophers, both in their manner of teaching, and in the opinions they adopted, followed the modern Platonic school, of which Ammoeus was the original founder. Their sect was for a long time held in the utmost veneration, particularly among the mystics; while the scholastic doctors, and all such as were infected with the itch of disputing, favoured the Peripatetics. But, after all, these reconciling Platonists were chargeable with many errors and follies: they fell into the most childish superstitious, and followed, without either reflection or restraint, the extravagant diatribes of their wanton imaginations. The Calixtins, who, in the close of the seventeenth century, endeavoured to promote union and concord among Christians in the different churches, were also called Syncretists. The principles upon which Calixtus's pacific and uniting plan was founded were, 1. That the fundamental doctrines of Christianity, by which he meant those elementary principles from which all its truths flow, were preferred pure and entire in all the three communions, (Romish, Lutheran, and Reformed,) but were contained in the ancient form of doctrine, vulgarly known by the name of the Apologists' creed; and 2. That the tenets and opinions, which had been constantly received by the ancient doctors during the first five centuries, were to be considered as of equal truth and authority with the express declarations and doctrines of scripture. Moshheim's Eccl. Hist. See Calixtins.

SYNCRISIUM, συγκρίσις, a word used by the chemical writers to express a concretion, or coagulation of any thing, effected by a spontaneous, or violent reduction of a liquid substance to a solid one, by a privation of the humid.

SYNCRISMA, a fort of ointment of the nature of the acopa, in use among the ancients.

SYNCRITICA, a name given by some writers to such medicines as are of a coercive and astringent quality, whether used externally, or given internally.

SYNDELEDFORD, in Geography, a gulf or bay in Vol. XXXIV.
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second day; and by this kind of synecdoche, the plural number is sometimes put for the singular, as Matt. xxviii. 44, compared with Luke, xxiiii. 30: by the fifth kind of synecdoche, part of any material thing or quantity is put for the whole of it, as the roof for the house, fails for ships, &c.; and thus also the singular number is put for the plural, and a number less than the real number is used for any round number. Ward's Orat. vol. ii. p. 2, &c.

SYNECHES, in Medicine, is the name of a fever of the next degree to the intermittent; it also seems to be something akin to the, and is called the Catarrhal or remitting fever. It is a continual fever in regard to duration, though not in degree, continuing many days together without intermission: but then it has its diminutions and augmentations; sometimes regular, sometimes irregular, though no true intermissions. Allen's Synopsis, p. 3.

SYNECHPHONESIS, or SYMPTOMESIS, in Grammar, a coalition, by which two syllables are pronounced as one.

It is much the same thing as the synallapha, or synecphet.

SYNECTICON, a word used by the old writers to express the proximate cause of a disease; called also the cause incomatus, and always remaining closely united with the disease.

SYNEDRELLA, in Botany, a genus of Gartner's, whose name appears to be a diminutive of ovoides, a military station, or camp, but we do not perceive its application. This genus is separated from Veratrum, see that article hereafter, because the author just cited found the receptacle naked, and the radius (of only two florets) placed on the outside of the inner calyx, while the seeds of these florets are fringed with teeth. But Swartz, who gathered the plant wild, describes a single calyx, without noticing any such peculiar situation of the radius, which he says consists of four or five florets; see his Hist. Bot. 312. Whatever stress therefore, may be laid on the naked receptacle, we feel scarcely authorized to follow Gartner, who perhaps saw an imperfect or anomalous specimen only, and we have only seen a dried one, by which we can neither trace nor invalidate the particulars of his description. The habit of the plant, greatly resembling Galanthus Tetrastichus, is indeed unlike that of the genuine Veratrum.

SYNEDRIN, or SYNEDRION. See SANGREDIN.

SYNEMMENON TETRACHORD, in the Greek Music. See GREEK MUSIC, and NERE.

SYNERGASMA, formed of synergy, and syngwan, I work, a word used by Libavius, and some other authors, to express any operation in chemistry. The operations are by this author divided into two classes, the energetic, and preparatory: the first producing such bodies as are of power to act on others as menstrua, to cure diseases, and the like; and the others producing no such things, but being necessary preparatives to them.

SYNERGISTS, formed of synergy, co-operation, in Ecclesiastical History, a name given to those whose doctrine was almost the same that of the Semipelagians, and who denied that God was the only agent in the conversion of sinfull men, and affirmed, that man co-operated with divine grace, in the accomplishment of this salutary purpose. The friends and disciples of Melanchthon adopted expressions of this kind, in describing the nature of the divine agency in man's conversion; but the Lutherans considered this representation as subverlive of the true and genuine doctrine of their master, relating to the absolute servitude of the human will, and the total inability of man to do any good action, or to bear any part in his own conversion. Strigelius defended the synergetic doctrine of Melanchthon, and Flicius maintained the ancient doctrine of Luther. Mohrheim Eccl. Hist.

SYNESUSIUS, in Biography, was a native of Cyrene, in Africa, of noble extraction, who united the characters of a Christian bishop and heathen philosopher. He studied philosophy under the famous Hypatia of Alexandria; passed the chief period of his life in secular employments; and from the year 397 to 400, resided at Constantinople as deputy from his native city to the emperor Arcadius. After his conversion to Christianity, he was elected bishop of the see of Philomai in 410, though he was not then in orders, and thought himself unfit for undertaking such an office. He wrote honestly his objections in a letter to his brother; and, when he converted, he was consecrated by Theophilus, primate of Egypt, who thought that a man whose life and manners were exemplary, could not be long a bishop without being illuminated by heavenly truth. The bishop, it seems, was not mistaken; and his competence to the exercise of episcopal authority may be inferred from the following fact. In the reign of the younger Theodosius, Libya was cruelly oppressed by the president Androniconus, who invades its modes of rapine and torture, and added sacrifice to robbery. Syenesius had tried in vain mild and pious admonition, inflicted against him a sentence of excommunication, dissolving his associations and their thrones, and at the same time used his interest with the Byzantines court to bring the offender to submission; and this was at length effected. It is not known when this bishop died.

Several writings on different topics, and 155 epistles of Syenesius, all in Greek, are still extant. One of which is a free and liberal discourse, entitled "An Oration concerning the Gospel, or the Art of Receiving," another short and ingenious piece is entitled "The Praefer Babel," in his "Dion Prusius," to the praises of that city; another, which adds an account of his own studies, and a sketch of philosophical learning. He wrote also "Homilies," and a book on "Dreams," which is said to contain some curious remarks on the nature and signification of those phenomena. In his "Letters" are many historical passages, sublime notions, and moral sentiments. The style of Syenesius is characterized as lofty and dignified, inclining to the poetical and rhetorical. The best edition of all his works is that of Petaux, Gr. and Lat. Paris, 1612. Morevi. Dupin. Lardner.

SYNESTIC, formed of synexies, I render confused, is sometimes applied by physicians to express the fluids that are in a confused state, and of a confusion; such as to make them resum in their shape, in opposition to liquid ones.

SYNGE, Edward, in Biography, an Irish prelate, the Bishop of Cork, was born in 1659 at Inish- nose, near Cork, and from the diocese-school at Cork, was removed to Christ-church college, Oxford; finishing his course of education at the university of Dublin. Having preached to crowded audiences with great approbation at Dublin, he was prefected in 1714, to the see of Raphry, and as he had displayed much zeal in his attachment to the house of Hanover, he was translated, in 1716, to the archbishopric of Tuam; on which occasion he generously rendered the quarter-archiepiscopal parts of his see, and procured an act for settling them on the resident clergy of the diocese. He was made a privy-counselor; and, in the absence of the lord-chancellor, one of the keepers of the great seal. These civil offices, however, did not interfere with his ecclesiastical duties; for he composed a number of tracts, partly practical and partly controversial, which, in his piety and his attention to the concerns of his See.
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fungi. Some of these kinds were very popular, and particularly his "Anwer to the Exegetes in wot coming to the Holy Commination," which had reached the 21st edition in 1752. This prelate died at Tourni in 1741, having been the son and the nephew of a bishop, and the father of two bishops. Bibliog. Brit.

SYNGENESIA, in Botany, from σύν, together, and γένεσις, generation, alluding to the combination of the male organs, or anthers, is the appellation given by Linnaeus to the 19th class of his artificial system. This great class is now, according to its general acceptance, one of the most natural possible; consisting of the compound flowers of preceeding writers, whose anthers are united into a tube. It is equivalent to Jussieu's 10th class, comprising his three orders of Cloraceae, Cinarocephala, and Caryobifera.

The essential character of the Syngenesia is, to have the anthers united into a tube, the filaments being, almost without exception, distinct; to which we now add, that the flowers are compound, consisting of several florets in one common calyx; each floret having a Stamina, and a pilt of its own, or, one of those parts, or neither; in other words, being perfect, male, female, or neuter. Linnaeus indeed admitted free flowers, with united anthers, into the present class, as Viola, Lobelia, Impatiens, &c. But this union is far from constant in such genera, whilst it occurs occasionally in others, not usually syngenesious, as Gentiana. Hence it is found most correct and commodious, as well as most natural, to abolish the Linnaean order of Syngenesia Monogynina, and to place its genera simply by their number of Stamina.

The following are the natural characters of the Syngenesia.

Common Calyx, in fact a gymnathium, containing the receptacle and florets, closing after flowering, and spreading generally when the seeds are ripe; it is either simple, surrounding the florets with a single ring of leaves; or imbricated, when the numerous leaves, or scales, are gradually shorter as they are more external, lying over the inner ones; or double, when a series of internal equal leaves, surrounding the florets, is encompassed at the base with another, more flatter, or more lax, and of a different form or aspect.

Common Receptacle, enclosed by the common calyx, supports several free florets. Its disk is either concave, flat, convex, conical, or globose: the surface being either naked, merely marked with slight dots or villous, covered with upright hairs; or chaffy, clothed with linear, awl-shaped, compressed, erect scales, variously shaped, separating the florets; or cellular, divided like a honeycomb, into angular spaces, by membranous partitions.

The Florets consist each of the following parts.

Calyx crowning the germen, in the form of a simple, sometimes oblate, border, or a series of five teeth, bristles, or hairs, becoming the pappus, or seed-down.

Corolla of one petal, with a long narrow tube, fringed on the germen; and either tubular, with a bell-shaped five-cleft limb, whose segments are spreading or reflexed; or ligulate, with a linear flat limb, directed outwards, entire, abrupt, three-toothed, or five-toothed, at the extremity; or deficient, being deftute of a limb, and often of a tube.

Stamina. Filaments five, capillary, very short, inserted into the throat of the floret; anthers as many, linear, vertical, erect, united laterally into a hollow cylinder, crowned with five teeth, on a level with the limb.

Pilif. Germen oblong, below the partial calyx and corolla, but above the common receptacle, erect, style thread-shaped, erect, the length of the Stamina, running through the cylinder formed by the anthers; Stigma in two revolving and divaricated segments or lobes.

Perianth really none, though in some instances the seed has a coriaceous crust; witness Osenpernum and Strumus.

Seed one, oblong, often quadrangular, for the most part contracted at the base, and variously crowned at the summit, either with a circular series of numerous simple, rough, or smooth hairs, or of branched coherent plumes; such a crown being in some instances fertile, in others tailed, or with five or more small scales or leaflets, originating from the partial calyx. Sometimes there is no more than a scarcely evident rim, or border, at the top of the seed, which in that case is termed naked.

The kinds of compound flowers, therefore, come under the following descriptions, and consist either

1. Of tubular perfect florets, in the disk as well as in the circumference.
2. Of tubular perfect florets in the disk, with tubular female ones in the circumference.
3. Of tubular perfect florets in the disk, with tubular neuter ones in the radius.
4. Of tubular perfect florets in the disk, with ligulate perfect ones in the radius.
5. Of tubular perfect florets in the disk, with ligulate female ones in the radius.
6. Of tubular perfect florets in the disk, with ligulate neuter ones in the radius.
7. Of tubular perfect florets in the disk, with naked female ones in the circumference.
8. Of tubular male florets in the disk, with naked female ones in the circumference.
9. Of ligulate perfect florets in the disk, as well as in the radius.

It must be observed that the first and last of these sections are the most permanently and essentially distinct. The second and third are aberrations of the fifth, and they are all capable of varying into each other. The same is the case with the fourth, fifth, and sixth, all closely allied to each other, though distinct from the fifth, second, and third. The seventh is most nearly related to the second, and they run into each other, which may also be said of the seventh and eighth.

Of these differences, however, the Linnaean Orders of the clasis Syngenesia are founded. See Polygymnia.

1. Polygymnia equilis, consists of sect. 9, 1, and 4.
2. Superfusa of 2, 5, and 7.
3. Fruticans of 5 and 6.
5. Segregata has no exclusive character of any, being distinguished by its doubly compound flowers.

However natural the class now under our consideration may be, it is not without exceptions or irregularities. Kubus, though a true compound flower in every part of its structure, has dissected anthers; which circumstance occurs, more partially, in Tufillo. A few inflorescences are found of genera in which the florets are, more or less, universally, four-cleft, with four Stamina, and in one species of Sinobezekia, they are three-cleft, with only three Stamina; see that article and Eclipta. In the generic character of the latter, line 4th, for nearly, read "nearly on the outside." A full more paradoxical exception occurs in our fifth species of Syruehina, see that article, which has solitary florets.

Linnaeus remarks, that Pluiter has not founded one new genus of compound flowers; that Tournesort fought
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out the most natural genera, though he wasted the information which has been supplied by later botanists; and that Vaillant has furnished more of this than any other person.

Jullien has treated the subject with his usual skill, and has thrown new light upon it. He judiciously observes that Tournefort and Linnaeus have been led into artificial distinctions; the former by being regulated too absolutely by the form of the corolla, and the latter by the sexes of the florets; while Vaillant, from whom Jullien adopts his own three orders above-mentioned, is the most correct.

Gartner, who in the latter part of his second volume has bestowed great attention upon this tribe, being chiefly mindful of the seeds and receptacle, with their appendages, has by, that means been led, if we mistake not, to form unnatural and unstable distinctions and combinations, which require to be brought to the test of long practical observation, and perhaps cultivation. His decisions, however, are the result of intense study and great experience, and his labours form a vast and faithful florehouette for the contemplation of future systematics, who may profit by his accuracy, if they do not implicitly follow his opinion.

SYNGNATHUS, the Pipe-fish, in Natural History. The name Lyngnathus is of Graecian origin, and is formed of the word nathan, which in composition signifies the name as the Latin con, together, and gnathos, a jaw. It is given to this fish from that remarkable structure of its mouth, by which the jaws are made to grow together, and the very end of the mouth only opens. The head of this fish is very small; the snout nearly cylindrical, long, turned up at the end; mouth terminal, without teeth or tongue, and furnished with a lid; the lower jaw is movable; gill-covers are large, friate and closed; the spiracle on the nape is tubular; the body is jointed, and mailed with many-fided scales; it has no ventral fins.

The fish of this genus inhabit the ocean, near the shores; they feed on leef worms and insects, and the spawned of other fish; under the tail, commencing at the vent, is a longitudinal groove, concealing the young and the eggs; the eyes of the animal are small, covered at the sides with a membrane; the nostrils near the eyes, but scarcely to be seen; the palate is smooth; the gill-membrane is very thin, placed on the nape; the fins are small, thin, the rays undivided; it has no lateral line. Gmelin enumerates eight species, of which four are found on the coasts of our own country.

Species.

TETRAGONUS. This species has no caudal fin; the body is quadrangular; the tail is fix-fided on the fore-part, triangular behind; the lip is round. This is an inhabitant of the Indian seas; the body is brown at the sides, beneath it is varied with brown and yellow. The iris is yellow; above the eyes, on each side, is a recurved spine, and a flat, hollow between them; the snout is compressed on each side; the trunk has 17 plates, paler in the middle, triangular at the beginning; above narrow, beneath broad, and sometimes with deciduate bands; the fins are yellowish; the tail is composed of 45 plates.

* TPHE, the shorter Pipe-fish. Caudal, anal, and pectoral fins radiate; body fix-fided. This, by some writers, is considered as a variety of the tetrangainus. It is found in the northern European seas, and on our own coasts; is about 12 inches long; the body is yellow, varied with brown. The snout is slender, flat-compressed; iris yellow; trunk with 18 plates; tail with 36; the vent is nearer the head; the fins are cianecous.

* ACUS; Needle-fish. This is also called the Great Pipe-fish, and the Heptagonal whistilpipe Pipe-fish, with brown bands and pinnated tail. The caudal, anal, and pectoral fins radiate; the body is seven-fided. It is usually found from 12 to 15 inches long, but in the Northern seas it is much larger, measuring from two to three feet; it is of an extremely slender form, gradually tapering towards the extremity, and is of a pale yellowish-brown colour, and throughout its whole length with broad alternate zones; a deeper or olive-brown, with a few smaller variegations intermixed; the sides are laminae with which the joints of the body are covered, appear, if narrowly inspected, to be finely radiated from the centre by numerous lines or streaks; the dorsal fin is placed rather nearer the head than the tail, and is thin, tender, shalow, and of no great extent; the pectoral fins are small, and slightly rounded, and the tail of similar shape and size. The ova are found lying in a longitudinal channel or division at the lower part of the abdomen; they are very large in proportion to the size of the fish. From these are hatched the young, completely formed.

PELAGICUS. Caudal and pectoral fins radiate; it has anal fin; the body is seven-fided. There is a variety, in which the plates of whose trunk are 3; of the tail 3; and the dorsal fin 33 rays. It is found on the fringed tail of the Cape of Good Hope, and in the Caspian sea; the body is of a yellow-brown, marked with transverse brown lines; it is generally found swimming among sea-weeds. The iris is white; the lower jaw is the longest; it has 18 plates on the trunk; on the tail 32; the pectoral fins are of a lead-colour; the dorital and caudal are yellow.

ÆQUORUS. Caudal fin radiate; it has no pectoral or anal fin; the body is angular. It is found in different parts of the ocean.

* OPHISDON; Little Pipe-fish, or Pipe-fish with round body and finless tail. This differs from the typhe, and the acus, in having the body nearly round, or at least is obscurely cornered as to appear round; it is also entirely destitute of a tail-fin, the body terminating in a naked point; it grows to the length of two feet, and is chiefly found in the Baltic. The iris is reddish, snout short, vent near the head.

* BARBARI; Longer Pipe-fish. This has neither caudal nor anal fins; the body is fix-fided. It inhabits the European seas; it is about two feet long; the body is of an olive-brown, with numerous blueish lines pointing from the back to the belly; the tail is quadrangular.

HIPPOCAMPSUS. This species has no caudal fin; the body is seven-fided, tuberculate; the tail is fique. The fish has a very fugular appearance; it is generally from 12 to 20 inches in length; the body is much compressed; it is of a greenish-brown, varied with darker and lighter spots; the head is large and rather thick, and beak at the upper part, as well as along some of the first joints of the body, with several small, weak, lengthened spines, or cirri, which are sometimes slightly ramified; the snout is slender, the neck suddenly contracting beyond the head; the body is rather short, and suddenly contracting towards the tail, which is long, quadrangular, and terminates in a naked or finless tip. In its dry or contracted state, the animal exhibits the fancied resemblance from which it takes its name, but in the living fish this appearance is somewhat less striking; the head and tail being carried nearly flatly. It is a native of the Mediterranean, Northern, and Atlantic seas.
SYGNOME, Eudoxus, in Rhetoric, the name with connection.

SYNGRAPH. See CHIRAGRAPH.

SYNIZESIS, blindaedas from a closure of the pupil. See PUPIL, Closure of.

SYNNAS, or SYNNAUM Storum, in the Writings of the Ancients, the name of a species of marble used in the larger buildings of the Romans. It is by some confounded with the dexamium marmor, with which the temple of Jupiter, erected by Hadrian, was built; but this is erroneous, since that elegant marble was always characterized as perfectly white, without blemish; and was always spotted and clouded with black, insomuch that some writers have called it by an epithet expressing those variations, maculae freinae.

SYNNEROSIS, in Anatomy, the connexion of parts by means of tendons.

SYNOCHA, in Medicine, expresses that kind of fever which is attended with high excitement and a general inflammatory state of the system; and is more particularly used in opposition to typhus, in which an opposite state, or one of diminished action, predominates.

An account of the history and treatment of synocha is included under that of FEVER, which see.

SYNOCHUS is a term applied to those cases of fever, in which a complication of the characters of synocha and typhus takes place; those of the former prevailing in the early stages, and those of the latter in the subsequent progress of the disease. See FEVER.

SYNOD, formed from synod, convention, assembly, compounded of συν, with, and οἶκος, house, and συν, with, in Astronomy, a conjunction or concourse, of two or more stars or planets, in the same optical place of the heavens.

SYNOD, Synodus, in Church History, a council, or a meeting or assembly of ecclesiastics, to consult on matters of religion.

Of these there are four kinds; viz.

General, or ecumenical, where bishops, &c. meet from all nations.

These were first called by the emperors, afterwards by Christian princes; till in later ages the pope usurped to himself the greatest share in this business, and by his legates presided in them when called. Of this sort there was but one within the first 300 years after Christ, and that was the council of Antioch, that condemned Paulus Samofatenus; or, if this will not pass for a general council, there was not any such before that of Nice, held A.D. 325.

National, where those of one nation only come together, to determine any point of doctrine or discipline. The first of this sort which we read of in England, was that of Hereford, or Hertford, in 679, and the last was that held by cardinal Pole, in 1555.

Provincial, where they of one province only meet, now called the convocation; and

Diocesan, where those of but one diocese meet, to enforce canons made by general councils, or national and provincial synods, and to consult and agree upon rules of discipline for themselves. These were not wholly laid aside, till by a act of submissio, 25 Hen. VIII. c. 19, it was made unlawful for any synod to meet, but for the royal authority. See COUNCIL and CONVOCATION.

SYNODS, Provincial, in the Government of the Church of Scotland, are composed of several adjacent parishes, of which there are fifteen in all. The members are a minister and a ruling elder out of each parish. These synods meet twice a year, and choose a moderator, who is their proctor. The acts of the synods are subject to the review of the general assembly, which is the dernier resort of the Kirk of Scotland; and confits of commissioners from presbyteries, royal burghs, and universities. A presbytery of twelve ministers, lends two ministers and one ruling elder; a presbytery of between twelve and eighteen, lends three and one ruling elder; of between eighteen and twenty-four, lends four and two ruling elders; of twenty-four, lends five and two elders; every royal burgh lends one elder, and Edinburgh two; every university lends one commissioner, usually a minister. The general assembly meets once a year, in the month of May, and is opened and adjourned by the king's royal commissary appointed for that purpose.

SYNODAL, or Synodical rents (commuted to two shillings), paid to the bishop or archdeacon, at the time of their Easter visitation, by every parish priest.

They were thus called, because usually paid in synods; because, anciently, bishops used to visit and hold their diocesan synods at once. For the same reason, they are sometimes also denominated synodalica; but, more usually, procurations.

In all probability, this payment is the same with that which was anciently called "Cathedralicum," as paid by the parochial clergy, in honour of the episcopal chair, and in token of obedience and subjection to it. Thus it stands in the body of the canon law: "No bishop shall demand any thing of the churches but the honour of the cathedralicum, that is two shillings," at the most, says the gloss, for sometimes less is given. Synodales are due of common right to the bishop only; so that if they be claimed or demanded by the archdeacon, or dean and chapter, or any other person or persons, it must be upon the foot of composition or prescription; and if they be denied when due, they are recoverable in the spiritual court.

Constitutions made in the provincial or diocesan synods, were sometimes called synodales, which were required in many cases to be published in the parish churches.

SYNODALES TYPUS was an appellation anciently given to...
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the urban and rural doves; from their informing against, and testifying, the disorder of the clergy and people in the episcopal synod.

When these sunk in their authority, in their head rose another sort of synodal witnesses, who were a kind of impampered jury, consulting of a priest, and two or three laymen, for every parish; though, at length, two for every dioceze were annually chosen; till, at last, the office came to be devolved on the churchwardens.

Some think our quechmen, who are affiants to the churchwardens, were called fidesmen, quasi synodifmen. See Sides-Men, and Quest-Men.

SYNODALE Instrumintum, a solemn oath, or engagement, that these synodical witnesses took: as our churchwardens now are sworn to the just prefements.

SYNODENDRUM, in Entomology, a genus of insects of the order Coleoptera. The generic character is as follows: antennae clavate, the club lamellate; thorax gibbous, muricate or unequal; lip sliform, horny, palpigerous at the tip. There are four species.

* CYLINDRICALON. Thorax truncate before, five-toothed; head with an erect horn. It is found in this country and other parts of Europe. The female is unarmed.

* MERICATUM. Thorax muricate, gibbous; shells two-spined before the tip. It inhabits Europe and America, in wood. The shells are dull tectateous, retuse behind, with a long hooked tooth at the future, and another shorter one at the margin; the antennae are tectateous.

* CAPECINUS. Shells entire, black; thorax rough before. It inhabits Coromandel. The thorax has numerous raised denticules before; the shells are naked, retuse at the tip.

DOMINICANUM. Smooth, black, dusky; shells fimbriate; legs pitchy. It inhabits South America, and is a very small insect. The head is black, bent under the thorax; the thorax is prominent before; shells entire, fimbriate.

SYNODICAL, something belonging to a synod.

SYNODICAL Epistles, are circular letters written by synods to the abbot prelates and churches; or even those general ones directed to all the faithful, to inform them of what had passed in the synod.

In the collection of councils are abundance of these synodical epistles.

MOMENT. Month is the period or interval of time, in which the moon, departing from the sun at a synod, or conjunction, returns to him again.

Kepler found the quantity of the mean synodical month, twenty-nine days, twelve hours, forty-four minutes, three seconds, eleven thirds.

This period is also called a lustration; because, in the course of it, the moon puts on all her phases, or appearances.

SYNONYMS. See Syndatales.

SYNODON, or SYNOD, in Ichthyology, a name given by several authors to a fish caught in the Mediterranean, and more commonly known by the name of dentex. It is a species of sbrus in the Linnaean system.

SYNONDONTIDES, in Natural History, the name of a stone described by the ancients, and said to be taken out of the head of the fish, called by them synodontes, the dentex of the moderns.


SYNOECLIA, Synoeclia, in Antiquity, a feast celebrated at Athens, in memory of Theseus's having united all the petty communities of Attica into one single commonwealth, the seat of which was Athens; where all the assemblies were to be held.

The feast was dedicated to Minerva; and, according to the scholiast of Thucydides, it was held in the mouth of the Agrippa.

SYNONYMOUS, SYNONYMOUS, is applied to a word or term that has the same import, or signification, with another. Accordingly, synonyms words agree in expressing one principal idea; but generally, if not always, they express it with some diversity in the circumstances. They are varied by some necessary idea which every word introduces, and which forms the distinction between them. Hardly in any language are there two words that convey precisely the same idea. A person thoroughly versed in the propriety of the language, will always be able to observe something that distinguishes them. In the Latin language, no two words seem to be more definitely synonymous than amare and diligere; and yet Cicero, in his Epistles, has marked a very obvious distinction between them. "Quid ergo tibi commendam eum quem tu ipse diligis? sed tuam ut scires eum non a me diligi folum, verum etiam amare, ob eam rem tibi haec scribo." Thus also tenuis and fenum, apparently synonymous and liable to be confounded as such, have nevertheles a different meaning; tenuis signifying a thing slender, and fenum free from the dread of it. Sempron (Epit. 97.) has marked the difference, "Tuta deinde & fenum, secura non fenum." In our own language, many infinities occur in which there is a difference of meaning among words reputed synonymous.

Dr. Blair has pointed out many of these. We shall find a few: e. g. astonishment, relating to the manner of acting; consternation, to that of thinking; rage, to that of punishing. In the first is opposed efficaciously, to the second, relaxation, to the third, clemency. Cursim respects the action, imibis the subject; by cursim, we mean the frequent repetition of the same act; by imibis, the effect which that repetition produces on the mind or body. Pride makes us esteem ourselves; vanity makes us desire the esteem of others; so that it is just to say with Swift, that a man is too proud to be vain. Haughtiness is founded on the high opinion we have of ourselves; disdain is on the low opinion we have of others. We invent things that are new; we discover what was before hidden; e. g. Galileo invented the telescope; Harvey discovered the circulation of the blood. A difficulty engenders us; an obstacle stops us; we remove the one and incumbe the other. Wisdom leads us to speak and act what is not proper; prudence prevents our speaking or acting improperly.

A wise man employs the most proper means for success; a prudent man, the safest means for not being brought into danger. See other infinities in Blair's Lectures, vol. i.

Some severe critics condemn all use of synonyms in the same period; but this is to condemn all antiquity: so far is the use of them from being vicious, that it is frequently necessary; as synonyms contribute both to the light and clearness of the translation. If the first word sketched out the resemblance of the thing it represents, the synonym that follows is, as it were, a second touch of the pencil, and finishes the image.

Indeed they must be used with great discretion and economy. The style must be raised and brightened, not suffused or loaded, with synonymous terms. They must be used as ornaments, and to render the expression the more forcible, without making a show of the riches of them, or heaping synonyms on synonyms.

But though synonymous words in some cases may be harmless,
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SYNTAX, in Grammar, the construction, or connection, of the words of a language into sentences or phrases. See Sentence.

F. Buffier more accurately defines syntax, the manner of constructing one word with another, with regard to the different terminations of them, preferred by the rules of grammar.

Some authors, as M. Vauclus, &c. confused syntax with style; but there is a real difference.

The office of syntax is, to consider the natural suitable-ness of words with respect to one another; in order to make them agree in gender, number, declension, and mood, 

To offend in any of these points, is called to offend against syntax; and such kind of offence, when gross, is called a solecism; and when more slight, a barbarism.

The several parts of speech are, with regard to language, what materials are with regard to a building. How well prepared they may be, they will never make a house, unless they are placed conformably to the rules of architecture. It is, properly, the syntax that gives the form to language; and it is on that which turns the most essential part of grammar.

There are two kinds of syntax; the one of concord, in which the words are to agree in gender, number, case, and person: the other of regimen, or government; in which one word governs another, and occasions some variation in them. (See Conform and Regimen.) The most comprehensive rule of syntax is that which we have numbered 10 under Regimen. It will apply to many forms of sentences, which none of the other rules can be brought to bear upon; and it is calculated to prove the propriety or impropriety of many modes of expression, which other rules, less general, cannot at all, or at least, cannot so readily, determine. See this rule exemplified in a great variety of appropriate cases, in Murray's Grammar, vol. i. and ii.

SYNTENOSIS, a word used by anatomists to express an articulation of the bones when they are connected, as the osseous joints of the toes, only by a tendon.

SYNTERICE, denotes that branch of medicine which is concerned in preparing of health.

SYNTEXIS, in Medicine, an attenuation, or colliquation, of the solids of the body; such as frequently happens in atrophies, inflammations of the bowels, colliquative fevers, &c. in which a fatty and oily substance is voided with the excrements by stool. See Colliquation.

SYNTHENA, a term used by Paracelsus to express an apoplectic or epileptic disorder, attended with violent gripping pains in the bowels. This is generally mortal.

SYNTHERISMA, in Botany, so named by Mr. Walter, in his Flora Caroliniana, p. 76, from συνθεωσις, to make a crop, or barrow, of itself in allusion to its abundant produce, as well as its popular name of Crop-grass. This supposed genus, however, is the identical Diphleria of Haller, under which appellation it stands in Pursh's Flora America Septentrionalis. We have followed Linnaeus in considering it as a section of the genus PAMICUM. See that article.

SYNTHESIS, in Grammar, from συν, with, and θεωσις, composition, or the putting of several things together: as in making a compound medicine of several simple ingredients, &c. See Composition.

SYNTHESIS, in Logic, denotes a branch of method, opposite to analysis.

In the synthetica, or synthetic method, we pursue the truth by reasons drawn from principles before established or assumed, and propositions formerly proved; thus proceeding by a regular chain, until we come to the conclusion.

Such
Such is the method in Euclid's "Elements," and most demonstrations of the ancient mathematicians, which proceed from definitions and axioms, to prove propositions, &c. and from those propositions proved, to prove others.

This method we also call composition, in opposition to analysis or resolution.

SYNTHESIS, in Grammar. See SYLEPSIS.

SYNTHESIS, in Surgery, an operation by which divided parts are e-united; as in wounds, fractures, &c.

SYNTHETIC, or SYNTHETICAL, is a term given to that part of chemistry, which, after the analytical chemistry has taken bodies to pieces, or reduced them to their principles, can, from those separated principles, either recompound the same body again, or, from the mixtures of the principles of one or more bodies in various manners, form a large set of new productions, which would have been unknown to the world but for this art: such productions are brady, soap, glass, and the like.

SYNTHETICAL chemistry, taken in the strict sense for the re-composition of bodies from their own principles, is rather of philosophical than of ordinary use. This, however, is not easy, except in a few cases, nor are we to imagine, because it may be done in some, that nature has taken this way to compose them; her method of composition of bodies is a new subject, and worthy a diligent inquiry. Shaw's Elements, p. 160.

SYNTHETIC Method. See SYNTHESIS and METHOD.

SYNTHETISMUS, in Surgery, the reduction of a fracture.

SYNTHONO, or DURUM, is the epithet by which Aretinexenex expresses one of the two common diatonic genera of which the tetrachord is divided into a semi-tone and two equal tones; whereas in the molle diatonic, after the semi-tone, the first interval is three-fourths of a tone, and the second two. See GENERA and TETRACHORD.

Befides the syntonic genus of Ariftenexenex, called also Diatono-Diatonic, Ptolemy has established another, by which he divides the tetrachord into three intervals: the first is a semi-tone major; the second, a tone major; and the third, a tone minor. This durum diatonic, or syntonic of Ptolemy, is retained, and it is nearly the diatonic of Didymus, with this difference, that Didymus places the tone minor before the tone major, Ptolemy the reverse.

The difference between these two syntonic genera will be felt with a single glance, by the ratios of the intervals of which both the tetrachords are composed.

Syntone of Ariftenexenex, \( \frac{2}{3} + \frac{2}{3} + \frac{2}{3} = \frac{4}{3} \)

Syntone of Ptolemy, \( \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{1}{3} \).

"There were other syntonic," says Rousseau, "of four different kinds, such as the ancient, the reformed, the tempered, and the equal; but it would be wasting our time, and abusing the patience of the reader, to drag him through all these divisions."

"SYNTHONO-LYDIAN, in Greek Music, the name of one of the ancient modes. Plato says, that the mixo-lydian mode and the syntonic-lydian, are plaintive, and proper to excite tears."

Aritides Quintilianus gives a lift, in his first book, of the different Greek modes, which we must not confound with the ecclesiastical modes that bear the same name, and which have been mentioned under the article MODE, in compliance with the practice of modern writers, which Glareanus introduced very improperly. The modes confused of different ways of varying the order of the intervals. The tones differed, as at present, in the fundamental sounds. It is in the first sense that we must understand the syntono-lydian mode mentioned by Plato, and of which we are unable to give any explanation. See PTOLEMY, and TEMPERAMENT.

SYNTHONUM DIATONUM. See GENUS.

SYNTRONIC, formed of συντρόφος, and τροφή, I nourish, an epithet used to certain dishes, which grew up with the patient. Of this kind is the epithet, which often signifies the person in infancy, and continues growing up with him, and increasing in strength as he does.

SYNULOTICA, medicines for healing of wounds.

SYNUISASTIS, SYNUISASTES, Συνυιστος, a form of συνοι, with, and συναιμφος, a sect of heretics, who maintained that there was but one nature, and one single substance, in Jesus Christ.

The Synuistais denied, that the Word assumed a body in the womb of the Virgin, but held, that part of the divine Word, being detached from the rest, was there changed into flesh and blood. Thus they taught that Jesus Christ was consubstantial to the Father, not only as to his divinity, but even as to his humanity, and very body.

SYNVMENSIS, a word used by some churlish writers to express a conjunction of two bones by means a membrane, as the bones of the incipit are connected to those of the fore-head in young children.

SYPHAR, a word used by some naturalists in the same sense as exercise, to express the skins which many roots cast off at certain times. The same, the water-cress, and all the caterpillar tribe, part with their skins during the time they remain in that state.

SYPHAK, in Geography, king of Maseylia, on the western part of Numidia, was engaged in the second Punic war on the part of the Romans against the Carthaginians, when he was defeated by Maffinia, and obliged to retire into Mauritania. He afterwards made a treaty with the Carthaginians, but a conference with Scipio, who had transferred the war to Africa, induced him secretly to enter into a negociation with that commander. Asdrubal, however, by means of his beautiful and accomplished daughter, brought him back to the interest of the Carthaginians; and an union with her was the price of a new alliance with Carthage. As soon as he found that his rival Maffinia had declared for the Romans, and that his mediation between the contending powers was of no avail, he delayed no longer to act in favour of the Carthaginians. Encamping his army apart from that of Asdrubal, both camps were in the night surprized and burned by Scipio. Afterwards, in a general engagement, the united Carthaginians and Numidian armies were defeated by Scipio; and Syphax, with the remnant of his forces, hastened back to his own country; but being pursuied by Lelius and Maffinia, he, together with his son Vermia, was taken prisoner. Maffinia then made a captive of Sophonisba, and married her, which was the occasion of a tragedy. Syphax was sent to Rome; and we learn from Polybius, that he was led to Scipio's triumph, and died a few days afterwards in prison; but other historians say that he was removed from Alba, his first place of confinement, to Tiber, where he died of grief before the return of Scipio from Africa. Univ. Hist. For other particulars, see CARTHAGINIANAE and MAFFINAE.

SYPHILIS. See LUES VENEREA.

SYPHON. See SYPHON.

SYPOMBRO, in Geography, an island on the coast of Brazil, in South America, about 7 leagues N.E. of St. John's island, and N.W. from a range of islands which form the great bay of Peru.

SYR, or ZUR, a town of Arabia; 184 miles E. of Amanzirifon.
SYRA, the ancient Syra, an island in the Grecian Archipelago, which, though mountainous, produces wine, figs, cotton, barley, and also wheat, although not so plentifully as barley. It has abundance of poultry, and fine breeds of pigs. This island has been always celebrated for the advantages it enjoys, in the excellence of its port, in its fertility, and in its fertility. It is thus extolled by Homer:

Εύβολος, μεγαλός, αντιλήπης, παλμήρος.

There is not a Turk upon the island; its inhabitants are all Greeks, and profess the Catholic religion. Also, a town is this island, built upon the summit of a lofty hill, so remarkable for its conical form, that it may be compared to a vast sugar-loaf, covered with houses. At the base of this cone is the quay, where are several warehouses for supplying vessels with the produce of the island, which is principally wine. Not far from the town are some ruins; and many ancient marbles are said to remain buried behind the magazines. Syros was the original name of the town, as well as of the island; 13 miles S. of Andros. Lat. 37° 37’. N. long. 24° 53’.

SYRA, a town of Japan, on the island of Ximo; 12 miles N. of Usumi.

SYRACUSE, a sea-port town of Sicily, in the valley of Noto, formerly a seaport city and flourishing republic; but almost totally destroyed, or at least very much reduced and diminished in extent and importance, by earthquakes, wars, and tyranny. In public and private wealth, magnificence of buildings, military renown, and excellence in all arts and sciences, Syracuse occupies a very distinguished, and, indeed, pre-eminent rank in the historical record of ancient nations: it was the most opulent, and the most powerful of all the Grecian cities, and by its own strength alone, it was able, at different times, to contend against all the power of Carthage and of Rome; and it is said to have repelled fleets of 5000 sail, and armies of 200,000 men; and to have contained within its own walls, what no city ever had before or since, fleets and armies that were the terror of the world. The great names recorded in its annals still command our veneration, though the trophies of their victories, and the monuments of their skill, have long since been swept away by the hand of time. This haughty and magnificent city is now reduced even below the consequence of the most insignificant burgh.

Syracuse was built, according to Thucydides and Strabo, by Archias, son of the Heracleid, who brought hither a colony of Corinthians, in the second year of the 11th Olympiad; and it is said to have borrowed its name from a neighbouring marble, called Syraco. This stately city contained within its walls, which were 18 miles in compass, four very considerable cities, as Strabo calls them, united into one, viz.: Acraga, Tyche, Neapolis, and the island of Ortygia.

Acraga, for an account of which, see Acraga, was situated on the sea-side, and separated from Neapolis and Tyche by a wall of an extraordinary thickness and height. The second city, called Tyche, stood between Acraga and the hill Epipole, having the former on the E. and Neapolis on the S. The chief ornaments of this division were a spacious and beautiful gymnasion, whither the youth resorted to learn all sorts of exercises; and several temples, greatly admired for their inimitable structure, especially that of Fortune, by the Greeks called Tyche, whence this division borrowed its name. The third quarter, called the Island, or Ortygia, was joined to Acraga, Tyche, and Neapolis, by a bridge. The most remarkable buildings in this part were the palace of Heron, which afterwards became the habitation of the Roman praetors; and two magnificent temples, the one dedicated to Diana, and the other to Minerva, the two tutelary goddesses of Syracuse. The temple of Minerva has been converted into the cathedral of the city, and dedicated to the Virgin. The left city was called Neapolis, or the New City, because it was built after the other three. The chief ornaments of this city were, a spacious amphitheatre and theatre, and two temples of wonderful architecture, consecrated to Ceres, and Liber and Proserpine. The statue of Apollo Temite, which was afterwards carried to Rome, is celebrated by Tully as the most valuable monument in Neapolis. Of these four cities, Ortygia alone is now remaining; it is about two miles round, and supposed to contain 14,000 inhabitants; though there are some traces, still visible, of the ancient Syracuse, in the ruins of the porticos, temples, and palaces. The famous fountain of Arethusa role in this island; but its spring is now dried up. (See ARETHUSA.) Near the city stood a hill, called Epipole, (see Epipole) exceedingly steep, and of very difficult access. When the Athenians besieged Syracuse, this hill was not inclosed by a wall, as in after-ages, but defended by a fort called Labdalon. On Epipole was the famous prison, called Latomize, which word properly signifies a "quarry." (See LATOMIZE.) Cicero has particularly described this dreadful prison, which was cut 125 paces long, and 30 feet broad, and about 100 feet below the level of the earth, cut out of the rock to an almost incredible depth. It was the work of Dionysius the tyrant, who caused those to be shut up in it, who had the misfortune to incur his displeasure. It now forms a noble subterraneous garden.

The whole city was environed by a triple wall, so flanked with towers and cisterns, at proper distances, that it was deemed impregnable. It had two harbours, at a small distance from each other, being only separated by the island; viz. the great harbour, and the small one, called otherwise Aretmus, both of which were surrounded by the same edifices. The great harbour was about 5000 paces in circumference; and the entrance of it 500 paces wide; being formed on one side by a point of the island Ortygia, and on the other by the little island and Cape Plemmynrum, which was defended by a fort of the same name. This, being reckoned six miles round, and lying on the S. W. side of the island of Ortygia, was esteemed one of the best in the Mediterranean. Diodorus says that it ran almost into the heart of the city, and was called "Marmoreo;" because it was entirely encompassed with buildings of marble; its entrance was strongly fortified, so that the Romans could never penetrate into it. The small port is on the N. E. of Ortygia, and is said to have been highly ornamented by marble edifices, reared by Dionysius and Agathocles. Fazello says, that there still remains a submarine aqueduct, that runs through the middle of it, which was intended to convey the water from the fountain of Arethusa to the other parts of the city. Near this port is shown the spot where the house of Archimedes stood, and likewise the tower from which he is said to have set fire to the Roman gallies with his burning-glasses. The catacombs, not inferior to those of Rome and Naples, and in the same style, the ear, of Dionysius, a monument of the ingenuity and magnificence, no less than of the cruelty of that tyrant, (see EAR OF DIONYSIUS,) and the remains of a great number of temples, have been objects of research and of admiration to those who have visited Syracuse. Above Acraga was a third port, called the harbour of Trogillus. The river Anapius ran about one mile and a half distant from the city, and discharged itself into the great
SYRACUSE.

great harbour. Near the mouth of the river, and about 500 paces from the city, stood a castle, called Olympia, from the temple of Jupiter Olympia, which was the chief ornament of the place. Thucydides, in his description of this city, (lib. vi), mentions only the three divisions of the island, Aegadina, and Tyche; so that Neapolis must have been added after his time.

Syracuse underwent several revolutions before it was taken by the Romans; but was always one of the most wealthy and powerful cities of those times; for Gelon, who made himself master of Syracuse in the year of Rome 260, and the other tyrants, his successors, were become equally formidable to the Greeks, Africans, and Asians. Dionysius the younger, who governed this city, kept in constant pay 100,000 foes, and 10,000 horse, besides a fleet of 400 sails.

The principal epochs of the history of Syracuse are as follow; though allowance should be made for the variations in the statements of different chronologers.

Years B.C.

736. Syracuse founded.
497. Hippocrates governed.
478. Gelon died.
467. Hiero I. died.
466. Thryphylus, 11 months.

[Sixty years of liberty.]

415. Syracuse besieged by the Athenians.
410. War against the Carthaginians.
368. Dionysius the elder died.
387. Dionysius the younger banished.
354. Dion died.
355. Calippus his fon.
354. Hypparion, son of Dionysius.
347. Dionysius returns.
333. Timoleon expelled Dionysius.
280. Agathocles died.
235. Hiero II. died.
214. Hieronymus his fon died.
212. Marcellus took the city.

It is not ascertained what kind of government first prevailed in the city of Syracuse. Atheneus and Elia mention a people named Polis, who resided there in early time, from which circumstance some have concluded, that the city was first governed by kings; but if monarchy was first introduced, it was soon changed into a democracy. A considerable obscurity involves the history of this republic for the space of 200 years; and therefore we must content ourselves with selecting a few particulars from the records that commence with the reign of Gelon, when Syracuse first made a considerable figure, and from which period it furnished many great and memorable events for an interval of above 200 years. During this time it exhibits a perpetual alternation of slavery under tyrants, and liberty under a popular government, till it was at length reduced by the Romans, and made part of their empire. For an account of Gelon, and the principal transactions of his reign, see Gelon. He was succeeded by his brother Hiero (see his biographical article); and Hiero, by his brother Tharyphylus, who was a savage and bloody tyrant, and was banished about the year 466 B.C. Upon his expulsion a popular government was introduced at Syracuse, and it was everywhere established and maintained till the reign of Dionysius the younger. The Syracusans, thus restored to their former liberty, convened a general assembly, which unanimously decreed, that a statue should be erected to Jupiter, the deliverer, of the size of a colossal; and that, on the anniversary of the happy day on which they had regained their liberty, solemn games should be exhibited, and 430 bulls sacrificed, by way of thanksgiving to the gods, and all the people entertained and feasted as a day of general rejoicing. It was also decreed, that the magistrates, according to ancient custom, should be chosen from among the chief citizens, and that none of the strangers, who had been made denizens by Gelon, should be admitted to employment of trust. This decree incensed the foreigners and was the occasion of new tumults in Syracuse. After several internal commotions and conflicts, the most important and interesting event that happened to Syracuse was the invasion of the Athenians. This brought on a war both by land and sea, which was prosecuted with alternate success and defeat and with great slaughter on both sides; till at length, after a contest of about three years, it terminated in favour of the Syracusans. See Callimiches.

When Hamilcar gained the city of Agrigentum, in a siege of eight months, the whole island of Sicily was struck with terror; and many of the inhabitants forsaking their native cities, fled to Syracuse, where they were treated with great kindness, and the chief men among them were free. However, many of these refugees were Agrigentines, and they filled the city with incitements against the Syracusan commanders, as if they had betrayed Agrigentum into the enemy's hands. These accusations caused disturbances in Syracuse, which gave Dionysius a favorable opportunity for seizing on the sovereign power, and depriving the inhabitants of that liberty which they had so abjured, and, by degrees, turned into licentiousness. For the principal events of his reign, and those of his immediate successors, we refer to the articles Dionysius I. and II. and Dion.

When Timoleon had succeeded in expelling Dionysius, and making himself master of Syracuse, it gained for Corinth and other cities of Greece a population amounting to above 10,000 persons. At the same time, great tumults of people from Italy, and other parts of Sicily, joined Timoleon, who distributed lands among them, but sold the houses, and, with the money arising from the sale, established a fund for the support of the poor and needy. He also, upon his settlement at Syracuse, appointed new magistrates, and instituted such laws as were most proper for the democracy. Among other wise institutions, he appointed a chief magistrate called Amphipolus of Jupiter Olympia; the first who followed this name and office being Callimiches. Hence arose the custom among the Syracusans of computing their years by the respective governments of these magistrates, which continued in the time of Diodorus Siculus, that is, in the reign of Augustus, above 300 years after the office of Amphipolus was first introduced. (See Timoleon.) For twenty years the Syracusans enjoyed the beneficial fruits of Timoleon's victories and conduct. At length a tyrant, exceeding all his predecessors in cruelty and all other vices, started up among them. (See Agathocles.) After his death, Syracuse underwent many revolutions, till, at length Hiero II. was declared king by the unanimous consent of the citizens, and soon after acknowledged as such by all their allies. (See Hiero II.) Hiero had formed the design of abolishing monarchy, and reforming the Syracusans to their ancient form of government, but was diverted from the execution of his purpose by one of his daughters, and her infringement bequeathed the crown to his grandson Hieron, whose vices and cruelty gave occasion to the Syracusans very much to regret the death of his grandfather. Besides their hatred, which he incurred by his misconduct,
he provoked the Romans by his contemptuous treatment of their ambassadors. The Romans commenced hostilities, and Hieronemus fell a sacrifice to a conspiracy among his subjects. Marcellus, who commanded the Roman army, besieged Syracusae both by sea and land; and though it was vigorously defended by the machines of Archimedes, which made great havoc among the Romans, it was after a three years' siege taken by assault, and the inhabitants were treated with singular clemency by the conqueror. The conduct of Marcellus ensured the lasting gratitude of the Syracusans to him, and to his posterity. (See Marcellus.) The conquest of Syracusae was soon followed by the reduction of the whole island. See Sicily.

The dioeces of Syracusae is said to produce above forty different sorts of wines; the honey of the hills is as clear as amber, and of a most delicious flavour; vegetables are here admirable in their kinds, especially broccoli, which grows to a prodigious size. The climate is singularly mild, so that it is admirably adapted for a winter's residence. In summer the marshes at the head of the port exhale vapours that infect the air, and endanger the lives of the inhabitants. A singular circumstance is mentioned by Brydone with respect to the climate, derived by tradition from the ancients, but the traveller does not vouch for the truth of it; that at noon the sun has been ever inviolate during a whole day at Syracusae; 71 miles S. of Melfi, and 115 S.E. of Palermo. N. lat. 35° 5'. E. long. 15° 14'.

SYRAU, in Geography, a town of Saxony, in the Vogtland; 4 miles N.W. of Plauen.

SYRE, a town of Norway, in the province of Christianiaand; 24 miles N.W. of Christianiaand.—Allo, a lake of Norway, in the province of Christianiaand; 50 miles N.W. of Christianiaand.—Allo, a river of Norway, which rises near the mountain Lang, runs through the vale of Syre into the lake of Lunde, in the dioeces of Christianiaand, and afterwards discharges itself into the sea, shooting like an arrow through a very contracted strait, between rocks; 20 miles W. of Syre.

SYRENS, SYRENS, in Antiquity. See SEIRENS.

SYRENIUS HIBULUS, in Ancient Geography, Illes de l'Syrene, islands of the Mediterranean, E. of the isle of Caprea, and S. of the promontory of Miserrva. They are three rocks, said to be inhabited by the Syrenae.

SYRIA, that part of Asia which, bathed by the Mediterranean on the W., had to the N. mount Taurus, to the E. the Euphrates and a small portion of Arabia, and to the S. Judea or Palestine. The Orientalists called it Aram, which see. The name, which has been transmitted to us by the Greeks, is a corruption or abridgment of Assyria, which was first adopted by the Ionians, who frequented these coasts after the Assyrians of Nineveh had reduced that country to be a province of their empire, about the year 750 B.C. By the appellation of Syria is ordinarily meant the kingdom of Syria, of which, since the reign of the Seleucidae, Antioch has been the capital.

The physical geography of this country presents to our notice some remarkable mountains and rivers. Towards the north is part of a chain of mountains denominated Taurus, which itself is included in the mountains extending from the N.E. to the S.W. On this side, and near the sea-coast, is the strait or passage called Phyle Syrie. Near Antioch, to the S., is a chain of mountains, which separates the course of the Oronites from the Mediterranean, and forces it to turn northwards to Antioch. This chain bears the name of Libanus. Farther N. one of the mountains bore the name of Laflus. The same chain is continued towards the S.W. as far as Tyre on the sea-coast. Another chain lies more to the E., and bears the name of Anti-Libanus. Among these mountains are valleys, and particularly that which is watered by the Leontes, and called Ceso-Syria; the latter including a space of about 25 leagues is one direction, and 25 in another. The most remarkable river of Syria is the Orontes, now called El-Ae. The Leontes we have already mentioned. The four ancient kingdoms comprehended in Syria, and distinguished by the Orientalists, were those which had for their capitals Damascus, Zohab, Hamath, and Geshur. After the death of Alexander, Syria was divided into five large provinces, viz. Comagene, the Seleucidae, Ceso-Syria, Phoenicia, and Judea. Adhering partly to this division, Strabo says that Syria comprehended four large nations, the Hebrews (or Jews), the Idumeans, the Gazzans, and the Assiotes. The partitions under the kings of Syria gave occasion to a greater number of provinces. Those belonging to Syria Proper, mentioned by Ptolemy, are the Comagene, Pieria, Cynorrhodica, the Seleucidae, the Cassotides, the Chalybonita, the Chalcides, the Apamea, the Laodicea, the Mediterranean Phœnia, Ceso-Syria, and the Palmyrene. By a change which took place in these divisions, a large province, formed to the E. by the Euphrates, was known under the name of Epiphraei. Comagene was the most northern part of Syria, extending N.E. between mount Amanus, from the S.W. to the E. Lus. mount Taurus to the N., and the Euphrates to the E. and S. The Euphrates extended, as we have seen, the Epiphraei, the course of which was here from N.W. to the S.E. It had a chain of mountains to the W. The Palmyrene was the eastern part of Syria, so called from the famous city of Palmyra, which see. Ceso-Syria formed the southern part of Syria, between the Libaus and Anti-Libanus. Its principal towns were Damascus, Abyla Lybar, Solani, Panas, Helipolis or Banha, &c. Phœnia of Libanus formed a part of Syria. The part called Lodiocare, or Laodicæ, lay towards the N. Here were situated Laodicæ ad Libanum, to the E. Emera, where there was a celebrated temple of the sun; to the N. Epiphanias, called Hamah; to the W. Raphanae or Rafañ, to the S., between the mountains, Lybar, N. of Lybar, and W. of Raphanae, Demetriae or Akkar; N.E. of this last place, Carion, and N.W. upon the Eleutherias, or Naher-el-Kibbir, Marriamme. The Apamea lay to the N. of Laodicæ, and was traversed by the Orontes from S.E. to N.W.; here were situated Larifia or Shizar, on the Orontes; Apamæa or Famich, on the bank of a lake to the S., and surrounded by a lake; to the N.E. of Apamæa were Marra and Andron; to the E. Caparee and Theleed. The Seleucidae comprehended the towns that lay on the sea-coast; such were Marathus or Marakia, Balana or Belena, Paltus, Gabala or Gebelich, and to the N.W., on a small promontory, Laodoceæ ad mare, or Ladikia. The tongue of land which advanced to the N.W. was called Cherefonius, having at its extremity Cape Ziaret, and upon the northern coast a small fortress called Heracles, or Meinaburg; and at a small distance towards the E. a small place called Cethela. At a small distance towards the N., on the sea-coast, at the northern extremity of a small peninsula, was Roda or Roda. On S.E. of the latter town was the island of Melibea. The second part of this division comprehended the town of Seleucia, named Pieria, from the adjoining mountain Pierius, which formed a small peninsula towards the N. At the extremity of this coast was the rock denominated Roffius Scopolus, and upon the northern coast of the peninsula was the town of Rhodus or Rofo. W. of Rhodos, and at the mouth of the Pyramus, was Aër; and between the mountains and the sea, the first called Syrie

4 X 3

Pylis.
SYRIA.

Pylis. The gulf bore the name of Ilicus Sinai, from the town of Ilius, situated on the northern coast, and belonging to Cilicia. On the eastern coast were Myriandrus, or Alexandria, Alexandria-Casa-Iphen, and Alexandria towards Ilius, or Alexandretta. In the midst of a valley, near a lake N.E. of Antioch, and on the course of a river, was a town called Hieracle, and more to the S., on a mountain, the temple of Gindon, and near it, the W. were Temples dedicated to the gods of the first men, of their beard and hair, which were preferred in the temple, in a vessel of gold or silver, on which was inscribed the name of the person who made the offering. The fight of a dead person rendered a person unfit to enter into the temple during the whole day.

The dynasty of Syria may be divided into two classes; those that are known to us in the first writings, or in the works of Josephus, acknowledged by the Orientalists, and the Seleucid kings, successors of Alexander, with whom we are more acquainted by Greek authors.

The first dynasty comprehends the kings of Zobah, such as Rehamos, Sabat, and Adrasa; the kings of Damascus, such as Rezen, Adad I. and II., Hazlon or Adad III., Tabrimon or Adad IV., Benhadad I., or Adad V., Benadad II. or Adad VI., Hazael or Adad VII., Benhadad III., or Adad VIII., Hazael IX., or Rezin or Haza, or Adad X.; the kings of Hamath, such as Tobi or Thah, or Adar of Joram; the kings of Gebur, such as Ammiad and Taim. The second dynasty comprehends the succession of Alexander's successors: such as Seleucus Nicator, Antiochus Soter, Antiochus Theos, Seleucus II., or Callinicus, Seleucus III., or Ceraunus, Antiochus III., or Margas, Seleucus IV., Piphilopator, Antiochus IV., or Epiphanes, Antiochus V., or Eupator, Demetrius Soter, Alexander Balas, Demetrius II., or Nicator, Antiochus, son of Balas, Diodotus Tryaneus, Antiochus VII., or Sidetes, Demetrius Nicator, Alexander Zebina, Seleucus V., Antiochus VIII., or Gemis, Antiochus IX., or Cyzicenus, Seleucus VI., son of Seleucus II., Antiochus X., son of Cyzicenus, Antiochus II., Philip, Demetrius III., Antiochus XII., Tigranes, Antiochus XIII., Tigranes, subject to the Romans, and in the year 63 B.C. Syria became a Roman province. See several biographical articles for a further account of all of these kings, and more especially of the Seleucid.

Syria, in Geography, called by the Arabians Baré Sham, a province of Asiatic Turkey, comprising the whole space contained between two lines, drawn, the one from Alexandretta to the Euphrates, and the other from Gaza to the desert of Arabia, bounded on the E. by the desert, and on the W. by the Mediterranean.

This country is, in some measure, only a chain of mountains, which divide themselves, in various directions, into one leading branch; and such, in fact, is the appearance it presents, whether we approach it from the side of the sea or by the immense plains of the desert. These mountains, as they vary their levels and situations, are also greatly changed in their form and appearance. Between Alexandretta and the Orontes, the hills, larches, oaks, beeches, laurels, yews, and myrtles, give them an air of liveliness, which delights the traveler in the several activities he meets with cypresses, envinced with figs and vines. The inferior branches, which extend to the northward of Aleppo, on the contrary, present nothing but bare rocks without verdure or earth. To the fourth of Antioch, and on the sea-coast, the hill-faces are proper for the cultivation of tobacco, olives, and vines (mount Canius excepted) on the side of the desert, the summits and declivities of the chain are almost one continued series of white rocks. To
SYRIA.

Towards Lebanon, the mountains are lofty, but are covered, in many places, with as much earth as fits them for cultivation, by industry and labour. There, amid the crags of the rocks, may be seen the not very magnificent remains of the bountiful cedars; but a much greater number of firs, oaks, brambles; mulberry-trees, figs, and vines. As we leave the country of the Druses, the mountains are no longer so high; nor so rugged, but become firmer for tillage: they rise again to the south-east of mount Carmel, are covered with woods, and afford very pleasant prospect; but as we advance towards Judea, they lose their verdure, their valleys grow narrower, they become dry and stony, and terminate at the Dead Sea in a pile of discolate rocks, full of precipices and caverns; while to the west of Jordan, and the lake, another chain of rocks, still higher, and more rugged, presents a still more gloomy prospect, and announces, afar off, the entrance of the desert, and the end of the habitable lands. A view of the country will convince us, that the most elevated point of Syria is Lebanon, on the south-east of Tripoli. See Lebanon.

The south of Syria, that is, the hollow through which the Jordan flows, is a country of volcanos. Earthquakes continue to be felt at intervals in this country. The coast in general is level and sandy, the bay of the north and south, examples of earthquakes which have changed the face of Antioc, Laodicea, Tripoli, Berytus, Tyre, Sidon, &c. In later times an earthquake is said to have devastated, in the valley of Balbec, upwards of 20,000 persons. It is remarked that, in Syria, earthquakes seldom happen but in winter, after the autumnal rains. In fo extensive a country as Syria, the soil varies. In general the land of the mountains is harsh and gritty; while that of the plains is fat and loamy, and exhibits every sign of the greatest fecundity. In the territory of Aleppo, towards Antioc, it resembles very fine sand, or Spanish sand. Everywhere, the earth is brown, and as fine as garden-mould. In the plains, such as those of Hauran, Gaza, and Balbec, it is often difficult even to find a pebble. The winter rains occasion deep quagmires; and on the return of summer, the heat produces, as in Egypt, large cracks in the earth several feet deep. The rivers, or rather rivulets, of Syria, are the Jordan, the Orontes, and the Adonis. They hardly deserve the name of rivers, as the channels of the Orontes and Jordan, the most considerable of them, are only 60 paces wide in places. The Jordan, indeed, has great depth; but if the Orontes were not impeded by successive obstructions, it would be quite dry during the summer. The obstructions that occur in several places, at the isles and in the course of the rivers, have contributed to form considerable lakes, such as those of Antioc, Aleppo, Damascus, Hauran, Tabaria, and the Dead sea.

As to the climate of Syria, it is different in different latitudes, and in different situations, such as the low and flat, or high and mountainous. While Reaumur's thermometers stand at 25 and 26 degrees upon the coast, it hardly rises to 20 or 21 among the mountains. Along the coast of Syria, and at Tripoli in particular, the lowest degrees to which the thermometer falls in winter are eight and nine degrees above the freezing point. As for the barometer, at the latter end of May, it rises at 26 inches, and never varies till October. In winter the whole chain of mountains is covered with snow, while the lower country is always free from it. In Syria we may fix two climates: one very hot, which is that of the coast and the interior plains, such as those of Balbec, Antioc, Tripoli, Acre, Gaza, Hauran, &c.; the other temperate, and almost like our own, which is the climate of the mountains, at least at a certain height. In this climate, the order of the seasons is nearly the same as in the middle provinces of France; the winter, which lasts from November to March, is sharp and rigorous. Not a year passes without snow, and the earth is frequently covered several feet deep with it for months together; the spring and autumn are mild, and the summer heat is absolutely intolerable. In the plains, on the contrary, as soon as the sun returns to the equator, the transition is rapid to oppressive heats, which continue to the end of October. But then the winter is so moderate, that the orange, date, banana, and other delicate trees, flourish in the open air; and it appears equally extraordinary and picturesque to an European at Tripoli, to behold, under his windows, in the month of January, a variety of fruit, which is the produce of Lebanon; for in the lofty head of Lebanon is a basin covered with ice and snow. It must nevertheless be observed, that in the northern parts, and to the east of the mountains, the winter is more rigorous, without the summer being less hot. At Antioc, Aleppo, and Damascus, there are several weeks of frost and snow every winter; which arises from the situation of the country, fill more than the difference of latitude. For, in fact, all the plain to the east of the mountains is very high above the level of the sea, exposed to all the wind from the north and north-east, and screened from the humid winds of the south and south-west. Befides, Antioc and Aleppo receive from the mountains of Alexandretta, which are within sight, an air which the snow, that covers them so long, must necessarily render very sharp.

Syria unites different climates under the same sky, and collects, within a narrow compass, pleasures and productions, which nature has elsewhere distributed at great distances of time and places. In spite of the barbarism of a government, which is an enemy to all industry and improvement, we are astonished at the very sight of the corn that is raised in this country. Sides wheat, rye, barley, beans, and the cotton-plant, which is cultivated every where, we find a multitude of useful and agreeable productions, appropriated to different situations. Paleikne abounds in selenium, and dourra as good as that of Egypt. Maize thrives near Balbec, and even rice is cultivated with success. They plant sugar-canes in the gardens of Saide and of Bairout, and find them equal to those of the Delta. Indigo grows, without cultivation, on the banks of the Jordan; tobacco is grown throughout all the mountains. As for trees, at Antioc and Ramla to the height of the beech; the white mulberry-tree constitutes the wealth of the whole country of the Druses, by the beautiful silks which are produced upon it; while the vine, supported on poles, or windings round the oaks, supplies grapes which afford red and white wines, that might rival those of Bordeaux. Gaza produces dates and pomegranates; Tripoli affords oranges; Bairout figs and bananas not inferior to those of St. Domingo; Aleppo enjoys the exclusive advantage of producing pashmas; and Damascus of possessing all the fruits known in the milder climates of Europe. With these numerous advantages of climate and of soil, it is not astonishing that Syria should always have been esteemed a most delicious country, and that the Greeks and Romans ranked it among the most beautiful of their provinces, and even thought it not inferior to Egypt. In more modern times, also, a pacha, who was acquainted with both these provinces, being asked to which he gave the preference, replied, "Egypt, without doubt, is a most beautiful farm, but Syria is a charming country-side.

Syria produces all our domestic animals, and, besides thefe, the buffalo, and the camel, whose utility is so well known.
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known. The jackals go in droves, and in uninfected places there are also hyenas and onces; but the country is free from lions and bears. Water-fowls are plentiful, but land game is less abundant.

On the mountains, and in all elevated plains which stretch to the eastward, the air is lighter, pure, and dry; while the coast, and especially from Alexandretta to Jaffa, it is muggy and heavy, and exceedingly unwholesome. In the course of a whole summer, few clouds are seen, and still less rain, which only begins about the end of October, and then is neither long nor plentiful: the husbandmen with it for to sow what they call their winter crop, that is, their wheat and barley. In December and January the rain becomes more frequent and heavier, and snow often falls in the higher country: it sometimes rains also in March and April; and the husbandman avails himself of it for his summer crop of sesame, dourou, tobacco, cotton, beans, and water-melons. The remainder of the year is uniform, and drought is more frequently complained of than too much wet.

Within 2,500 years we may reckon ten invasions, which have introduced into that country a succession of foreign nations: first, the Assyrians of Nineveh, who pawing the Ephraims about the year 750 before the Christian era, within 50 years, obtained possession of almost the whole country lying to the north of Judea; next the Chaldæans of Babylon, who having destroyed the power on which they were dependent, fought against, as heretics against, to his possessions, and completed the conquest of Syria, except the town of Tyre. The Chaldaeans were followed by the Persian, under Cyrus; and the Persians by the Macedonians, under Alexander. It then seemed as if Syria was about to cease being a vassal to foreign powers, and to obtain a distinct and independent government, according to the natural right of every country; but the people, who found in the Seleucidae only cruel despots and oppressors, fearing themselves reduced to the necessity of bearing some yoke, preferred the lightest; and Syria, yielding to the arms of Pompey, became a province of the Roman empire. Five centuries after, when the sons of Theodorus divided their immense patrimony, this country changed the capital to which it was to appertain, without changing its masters, and was annexed to the empire of Constantinople. Such was its situation, when, in the year 632, the Arabian tribes, collected under the banners of Mahomet, feigned, or rather laid it waste. Since that period, torn to pieces by the civil wars of the Fatimides and the Omrides, wracked from the caliphs by their rebellious governors, taken from them by the Turkman foldiery, invaded by the European crusaders, retaken by the Mamluks of Egypt, and ravaged by Tamerlane and his Tartars, it has at length fallen into the hands of the Ottoman Turks, who have been its masters nearly three centuries. The inhabitants may be divided into three principal classes: the poverti of the people conquered by the Arabs, that is, the Greeks of the lower empire; the poverti of the Arabian conquerors; the present ruling people, the Ottoman Turks: of these three classes, the former must be again subdivided, in consequence of several distinctions which have taken place among them. The Greeks, then, must be divided into Greeks Proper, usually called Christian, or Sephardie, from the Romish communion; Latin Greeks affiliated to that communion; Maronites, or Greeks of the sect of the monk Maron, formerly independent of the two communions, but at present united to the latter. The Arabs must be divided into the proper descendants of the conquerors, who have greatly intermixed their blood, and are considerably the most numerous; Mutuals, distinguished from these by their religion; the Druzes, distinct likewise from the same reason; the Aftarians, who are also descended from the Arabs. To these people, who are the cultivators and settled inhabitants of Syria, must still be added three oder wandering tribes, or paltors, viz. the Turkman, the Coss, and the Bedouin Arabs: such are the different races inhabited over the country, between the sea and the desert, from Gaza to Alexandretta. In this enumeration, it is remarkable that the ancient inhabitants have no meaning representative; their distinguidng character is lost and confounded in that of the Greeks, who, in fact, by a continued residence from the days of Alexander, have had a sufficient time entirely to take place of the ancient people: the country alone, and a few traits of manners and customs, preserve the vestiges of distant ages.

The Syrians are, in general, of a middling stature, and are, as in all warm countries, less corpulent than the inhabitants of the north. We find, however, in the city some individuals whose amplitude of frame proves that the influence of diet is able, in a certain degree, to counterbalance that of climate. The general language of Syria is the Arabic tongue. In Syria, as in all the Arabic countries, the dialects vary at every place. The Syriac may be, therefore, regarded as a dead language; for the Maronites, who have preferred it in their liturgy, and use it for their mafis, understand very little of it, while they use them. The Turkish language is only used, in Syria, by the military, persons of office, and the Turkmans here. The Arabic of Syria is much akin to that of Egypt.

Among the different inhabitants of Syria, some are dispersed over every part of the country, and others confine themselves to particular spots. The Greeks Proper, the Turks, and the Arabian peasants, belong to the same class, with this difference, that the Turks reside only in the towns where they are in possession of the military emoluments, and the offices of the magistracy, and when they exercise the arts. The Arabs and the Greeks inhabit the villages, and form the class of husbandmen in the country; and the inferior class in the towns. The part of the country which contains the most Greek villages is the pashalic of Damascus.

The Greeks of the Romish communion, who are not less numerous than the schismatics, are all settled in the towns, where they cultivate the arts and commerce. The protection of the Franks procured them, in the late war, decided superiority in trade, wherever there are European settlements.

The Maronites form a national body, which occupies almost exclusively the whole country comprised between Naher-el-kelb (the river of the Dog) and Mak-el-keld (the cold river), from the summits of the mountains on the coast, to the Mediterranean on the west.

The Druzes border upon them, and extend from Naher-el-kelb to the neighbourhood of Sour (Tyre), between the valley of Bekaa and the sea.

The country of the Motoufias formerly included the valley of Bekas, as far as Sour; but this people, of late years, have undergone a revolution, which has reduced them almost to nothing.

The Turks, the CURDS, and the Bedouins, have so many fixed habitations, as to be perpetually wandering with their tents and herds, in limited districts, of which they hold upon themselves as the proprietors. The Turkmans generally encamp on the plain of Antioch; the Curch is the
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the mountains between Alexandretta and the Euphrates; and the Arabs spread over the whole frontier of Syria, adjacent to their deserts, and even the plains of the interior part of the country, as those of Palestine, Bekas, and Gallilee.

Syria is divided into five governments, or pachalics, viz. the pachalics of Aleppo, Tripoli, Damascus, Acre, and Palestine; the whole of which is, by a modern traveller, computed to bring into the grand fiscus treasury the sum of 312,000l. sterling, and the produce of Syria is estimated at 1,281,350l. All the troops of the five pachalics united amount to no more than 5700 men. Syria is flated by the same writer as containing 452,000 square leagues, at the rate of 150 in length, and 35 in breadth; and supposing the total population to be 28 millions, we shall have, upon an average, 475 inhabitants to a square league.

The government of the Turks in Syria is a pure military despotism; that is, the bulk of the inhabitants are subject to a fraction of armed men, who dispose of every thing according to their interest or caprice. When the Ottomans, under Sultan Selim, took Syria from the Mamlouks, they considered the country only as the spoil of a vanquished enemy; as a possession acquired by the law of arms and war. Now, according to this law, among barbarous nations, the vanquished is wholly at the discretion of the victor, he becomes his slave, his life, his property, belong to his conqueror; he is held as a slave and that he is his mere property, he is sold for nothing, and grants what he leaves him as a favour. Such was the law among the Greeks and Romans; and among all these societies of robbers whom we have honoured with the name of conquerors. Such, at all times, was that of the Tartars, from whom the Turks derive their origin. On these principles, even their first social state was formed. The Turkish empire may be compared to a plantation in one of our sugar islands, where a multitude of slaves labour to supply the luxury of one great proprietor, under the inspection of a few servants, who take good care of themselves. There is no difference, except that the dominions of the sultan being too vast for a single administration, he is obliged to divide them into smaller plantations, and separate governments, administered in the same mode as the united empire. Such are the provinces under the government of the pachas. See PACHA.

The people of Syria in general, with regard to religion, are Mahometans or Christians. This difference of opinion is productive of the most disagreeable effects in their civil state. Treating each other mutually as rebels, infidels, and impious, the followers of Jesus Christ and Mahomet are actuated by a reciprocal aversion, which keeps alive a sort of perpetual war. Faithful to the spirit of the Koran, the government treats the Christians with a severity, which displays itself in varied forms. Mention has been sometimes made of the toleration of the Turks; the following is the price at which it is purchased. All kind of public worship is prohibited the Christians, except in the Kefraouan, where the government has not been able to prevent it. They cannot build any new churches; and if the old ones fall to decay, they have no right to repair them, unless by a permission which costs them very dear. A Christian cannot visit a Mahometan without risk of his life; but if a Mahometan kill a Christian, he escapes for a stipulated price. Christians must not mount on horseback in the towns; they are prohibited the use of yellow fippers, white hawals, and every sort of green colour. Red for the feet, and blue for the drabs, are the colours assigned them. The Porte has just renewed its ordinances to re-establish the ancient form of their turbans; they must be of a coarse blue muffin, with a single white border. When they travel, they are perpetually stopped at different places to pay "hafara," or tolls, from which the Mahometans are exempt. In judicial proceedings, the oath of two Christians is only reckoned for one; and if it is the partiality of the cadi, that it is almost impossible for a Christian to gain a suit. In short, they alone are subject to the capitulation, called "kaudi," the ticket of which bears these remarkable words: "Djaas-el-ram," that is, (redemption) from cutting off the head; a clear proof of the title by which they are tolerated and governed. These distinctions, so proper to foment hatred and divisions, are diffeminated among the people, and manifest themselves in all the intercourse of life.

The sultans having arrogated to themselves, by right of conquest, the property of all the lands of Syria, the inhabitants can no longer pretend to any real, or even personal property; they have nothing but a temporary possession. When a father dies, the inheritance reverts to the sultan, or his delegate; and the children can only redeem the succession by a considerable sum of money. Hence arises an indifference to landed estates, which proves fatal to agriculture. In the towns, the possession of houses is in some measure left uncertain and left ruinous; but everywhere the preference is given to property in money, as more easy to hide from the rapine of the defiat. In the tributary countries, such as those of the Drufes, the Maronites, Flanis, etc., there exists a real and a sure property, besides the rents, which are disposed of as the property which their petty princes dare not violate; on which account, the inhabitants are so attached to their estates, that it is very rare to hear of alienation of lands among them. There is nevertheless one method, even under the Turkish government, of securing a perpetual usufruct, which is by making what is called a "wakf," that is an endowment or donation of an estate to a mosque. The proprietor then becomes the irrevocable guardian of his property, on condition of a fine, and under the protection of the profilers of the law; but this act has this inconvenience, that instead of protecting the mean of the law frequently devour the property; and, in that case, to whom are they to look for redress, since the embiezars of the property are at the same time the distributors of justice? For this reason, these lawyers are almost the only landholders; nor do we fee, under the Turkish government, that multitude of small proprietors, who constitute the strength and riches of the tributary countries.

The ranks or different conditions of persons in Syria may be reduced to four or five: the cultivators or peasants, artisans, merchants, military men, and those in all the different departments of the law and juridical officers. These various classes again may be comprehended under two others; the people, which includes the peasants, artisans, and merchants; and the government composed of the military, and legal and judicial officers. According to the principles of their religion, the power should reside in the latter order; but since the disposition of the caliphs by their lieutenant, a distinction has taken place between the spiritual and temporal power, which has left only the former to the sultan, under the authority of the imam. Such is that of the grand mufle, who represents the caliph, among the Turks. The real power is in the hands of the sultan, who represents the lieutenant, or general of the army. That favourable prejudice, however, which the people entertain for dethroned powers, still presides to professors of the law a credit, of which they almost always avail themselves, to form a party of opposition. The sultan is awed by it at Constantinople; nor do the pachas venture too openly to thwart it in their provinces. In each city this party
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party is headed by the mufti, who derives his authority from that of Conftantinople; his employment is hereditary, and not venal; which finge circumstance has prefered more eminence in this body than in all the others. From the privilege they enjoy, the families which compose it bear a considerable refemblance to our nobility, although its true type be the army. They re semble also our magiftracy, our clergy, and even our citizens, as they are the only perfon in that country who live on their rents. From them to the pefantry, the artificers, and traders, the defcent is fudden; yet, as the condition of these three fclaves form the true standard of the police and power of an empire, we fhall felect the particulars best calculated to enable the reader to form juft ideas.

The peffants in Syria, and alfo throughout the Turkish empire, are deemed felves of the sultan, i. e. as the term imports, they are his fubjeft. Although he is maker of their lives and property, the sultan does not fell men; he does not limit them to a certain spot. If he beefows an appanage on fome grazeed, it is not faid, as in Ruflia and Poland, that he gives 500 or 1000 peffants; in a word, the peffants are opprefled by the tyranny of the government, but not integrat ed by feudal fervitude. In order to render the collection of the revenue more easy, fultan Selim, after he had conquered Syria, ettablished a fingle territorial tribute, called the "Miri," (which fce.) This he ettablished at an irrevocable rate, but the pefcians and their agents have adopted a variety of changes, which produce all the effects of an augmentation. Praefiding numerous modes of oppreffion and extortion, the poorer clafs of inhabitants cannot pay the miri, and leaving their villages fly into the cities; but the miri being unalterable, the burthen on those who remain becomes infupportable. Nothing is more def tructive to Syria, than the shameful and exorbitant uitry customary in that country. When the peffants are in want of money to purchase grain, cattle, &c. they are obliged to mortgage the whole, or part, of their future crop, greatly under its value. From these and a variety of other circumftances, which we cannot detail, the condition of the peffants is extremely wretched. They are every where reduced to a little flat cake of barley or dourra, to onions, lentils, and water. They are fo little acquainted with dainties, that they efcape from oil and rancid oil as defecrative. All Turfhan and Nabob grain is henceforth wretchedly difcouraged; his plough is often no more than the branch of a tree, cut below a bifuration, and used without wheels. The ground is tiled by affes or cows, rarely by oxen. In diftricts like Palestine, exposed to the Arabs, the countryman must fow with a mufket in his hand. The corn, before it changes colour, is reaped, but concealed in fubterraneous caverns. The whole induftry of the peffant is limited to a supply of his immediate wants; and to procure a little bread, a few onions, a wretched blue flift, and a bit of woollen, much labour is not neceffary.

The artificers and traders, whose property is more capable of concealment than that of the peffants, escape more easily from the rapacity of their rulers. Hence it is that the towns in Syria, and other parts of Turkey, are populous. Commerce, as to the mode of conducting it, is still in Syria such as it excels in barbarous ages and uncivilized countries. Along the coaf there is not a harbour capable of admitting a veque of 400 tons, nor are the roads secured by forts. In the interior parts of the country, there are neither great roads nor canals, nor even bridges over the greater part of the rivers and torrents; however necessary is water. The communication between one town and another is maintained by carriages, who have no fixed time of departing, because their safety depends on the troops that accompany them, and the number of fellow-travellers. In Syria there is neither waggon nor cart, probably because they are likely to be feized by the minions of government. Every thing is conveyed on the backs of mules, asses, or camels. The camel is chiefly ufed on the plains, because he consumes less and carries more; his usual burden being about 400 pounds, and his food, fraw, branbles, pounded dates, beans, nuts, of 40 or any thing 60 a word, which you charge to give him. With a single pound of food, and as much water in a day, he will travel for weeks in succession.

Here are no inns for the accommodation of travellers; but the cities, and commonly the villages, have a large building called a Kan, or Caravan-farai, which serves as an at lumn for all travellers. The weights and measures vary at different diftricts; but the value of the coin is more fixed; and you may travel over the whole empire, from Kothia to Afsouan, without experiencing any change in its denominations or value. The monftrous coin called also mendi, fadda, kata, or mefria: its fixe is that of an Englifh silver three-pence, and its value formerly more than a half-penny. Next to the para are pieces of 5, 10, and 20 paras; then the zollata or iolote, which is worth 30; the piaffe, called kerth-afadi, worth 40 paras, two shillings and a penny; and the abou-kelb, or pude of the dog, which is worth 60 paras. All their coins are silver, with a confiderable alloy of copper. The gold coins are the fequins, called kalb, or piece of gold, and sile, or mahalabou, or well-beloved flower; this is worth 300 paras, or 40 pounds. The rich and called faldar, is worth 170 paras, but it is very rare. Besides these coins, which belong to the whole Turkish empire, some of the European fpecies have as much currency; fuch as the silver dolar of Germany, and the gold fequins of Venice. The dolars are worth in Syria from 30 to 22 paras, and the fequins from 205 to 208. The Venetian fequins are much valued in account of the firmness of their standard, and because they are much ufed for women's trinkets. The practice of weighing money is general in Syria, Egypt, and the whole empire of Turkey. The monftrous coin of Syria is in the hands of the Franks, Greeks, and Armenians; formerly it was engrossed by the Jews. France is faid to have led the greatest trade to Syria of any European nation. The imposts confifted in five principal articles, viz. the cloths of Languedoc, cochineal from Cadiz, indigo, fugar, and Chind Indiga coffee; to which may be added hardware, callas, sheet-lead, tin, Lyons lace, foop, &c. The reft of the country is almost wholly in cottons, either linen or raw, or manufactured into coarse fluffs, in some fells of Tripoli, in gauze, in cotton, and wool. The factories ufed to be few in number, viz. Aleppo, Scandereroon, Latakia, Tripoli, Sakh, Acre, and Ramla. The arts and trades in Syria depend on a variety of circumftances. In the villages, the inhabi tants, limited to mere neceffaries, have no arts but those without which they cannot subsist. Each family manufactures the coarse cottons neceffary for clothing. Every houfe has its portable mill, with which the women grind the barley or dourra for their subsistence. The arts in this country lead our views back to ancient times. The art of manufac tur ing fluffs at Aleppo was borrowed from the Arabs, and by them probably derived from the ancient Orientals. The dyes are as old as the times of the Syrians; and the cement they ufe is, without doubt, that of the Greeks and Romans.
in making it, they take care to use the lime when boiling; they mix it with one-third of sand, and another of ashes and brick-dust. With this composition they form wells, citadels, and vaults, through which the water cannot pass. The manner of working the iron mines in Lebanon is that which is now employed in the Pyrenees, and known under the name of the "Catalonian forge." The furnace consists of a chimney formed on the side of a deep declivity: the furnace is filled with wood, which is set on fire; the bellows are applied to this fire, and the iron ore wedged in from above; the metal falls to the bottom, and is taken out by the fame mouth at which the fire is lighted. Their music does not appear to have an earlier origin than the age of the caliphs. Dancing is held in low estimation by the Arabs. The sciences are more neglected than the arts, and, it is said, totally unknown. The barbarism of Syria, as well as that of Egypt, says Volney, is complete. Education is in a very low state, and receives little encouragement. Children are taught to read the Koran, if they are Mahometans, or the Poma, if Christians; they learn a little writing, and reckoning from memory; and here their proficiency terminates. The principal cause of the ignorance and inattention to improvement that prevails is the scarcity of books. There are but two libraries throughout Syria, that of Maranah and that of Djezzar at Acre. It is impossible for books to be multiplied and for knowledge to prevail without printing and a free press. We may, however, trace the ignorance of the Orientals to the government, which does not encourage the propagation of knowledge, but exerts every effort to stifle it in its birth.

As to the manners and character of the inhabitants of Syria, we may observe in general, that they exhibit a grave and phlegmatic exterior, and almost little deportment, and a serious, even sad and melancholy countenance. These traits of character are ascribed not to the climate or soil, but principally to the nature of the government under which the Syrians live. They may also partly be ascribed to the restraints of social intercourse, and more especially that between the sexes. But we must not pursue these reflections any farther. See Volney's Travels in Egypt and Syria, in 2 vols. 8vo. Paris.

Syria, in Ancient Geography, an island on the coast of Asia Minor. Pliny reports that in his time this was part of the continent, near the town of Ephesus.

Syria Salutaris. Pompey conquered Syria in the year of Rome 689, B.C. 63; and under the reign of Theodosius the younger, it was divided into two parts, one of which, having Antioch for its capital, was called Salutaris, on account of its hot baths, which lay in the mountains situated between Orontes and the sea.

SYRIAC BIBLE. See SYRIAC BIBLES, and SYRIAC VERSION, infra.

Syriac Language, a dialect of the ancient Chaldee, which the learned divide into three different dialects, vis. that of Babylon, which is the Chaldee language in its purity; that of Jerusalem, which was used by the Jews after their return from their captivity at Babylon; and that of Antioch, which was used by the Christians of Cosamene, and some other provinces bordering upon Syria, when this was the native language of the country. This last is that which is now more particularly called the Syriac language; and into this language the Old and New Testaments were translated. The Syriac is said by Niebuhr, Maslech, and some others, to be still the vulgar tongue in some villages of the mountains in Syria. Volney, however, having interrogated several monks who were well acquainted with the country on this subject, was not able to obtain a confirmation of this fact. He was merely told, that in the towns of Maloula and Sidnaea, near Damascus, they speak a dialect so corrupted, that it is difficult to be understood. But this difficulty proves nothing, since in Syria, as in all the Arabian countries, the dialects vary at every place. The Syrian therefore, as he says, may be regarded as a dead language; for the Maronites, who have preferred it in their liturgy, and in their miscellaenae very little of it, while they reject it. The Syriac language bears a near affinity to the Hebrew and Aramaic in the number of its letters, though the form of its characters is different, and in a variety of other particulars relating to its construction and syntax. It is however, in its connection with the versions still extant, highly important and useful; and an acquaintance with it is desirable by every biblical scholar. In order to facilitate the acquisition of it, Maclellan has annexed to the second edition of his Hebrew Grammar (vol. ii.) a Syriac Grammar without points. See CHALDEE, HEBREW, LANGUAGE, and SYRIAC VERSION, infra.

SYRIAC VERSION, a version of the Old and New Testaments, which is said to have been made, if not before the death of St. John the apostle, yet very soon after that event. The translator was a Christian well skilled in the Hebrew, Greek, and Syriac languages. The learned who have examined this version, and compared it with the original, both of the Old and New Testaments, inform us, that of all the ancient versions, which are now consulted by Christians for the better understanding of the holy scriptures, as well as of the New Testament as of the Old, none can better serve this end than this old Syriac version, when carefully consulted and well understood. And to this purpose the nature of the language itself very much affords; for as it had been the mother-tongue of those who wrote the New Testament, and a dialect of that in which the old was first given to us, many things in both are more happily expressed in this version than can well be done in any other language. This Syriac version of the whole sacred scripture is still used by the Maronites, a number of Christians dwelling about mount Lebanon. (See MARONITE.) Their liturgy is also in this language. It is used also by the Nestorians (see NESTORIAN), and also by the Jacobites. (See JACOBITE.) There is also another Syriac version of the Old Testament, made from the Greek of Origen's Hexapla, which is not so much esteemed.

The old Syriac version of the New Testament, which ought to be carefully distinguished from those made in a later period, contains only the four gospels, the Acts of the Apostles, the epistles of St. Paul, including that to the Hebrews, the first epistle of St. John, the first epistle of St. Peter, and the epistle of St. James. It is called by the Syriacs "Peshito," that is, the literal, though in fact it is much less so than the new Syriac version. It has neither the form of the abstracts, in the eighth chapter of St. John's Gospel, nor the celebrated passage, John, v. 7. The epistle to the Hebrews, though contained in all the copies of the Peshito, seems not to have been translated by the same person, who also translated the other books of the New Testament, which circumstance is thus accounted for by Michaelis. The old Syriac translator made his version from the earliest collection of the books of the New Testament, in which the epistle to the Hebrews was not included, because its authority was doubted; the translation of the New Testament was followed by that of the Old, and in the mean time, the epistle to the Hebrews having been admitted into the sacred
Syr.-canon, it was afterwards translated into Syriac by a different performer: who this performer was, and in what age he lived, a total want of historical account makes it impossible to determine.

This version was first made known in Europe by Mofes of Mardin, who was sent by Ignatius, patriarch of the Maronite Christians, in the year 1552, to pope Julius III., to acknowledge on behalf of the Syrian church the supremacy of the Roman pontiff, and was commissioned to have the Syriac New Testament printed in Europe. This work was undertaken by Albert Widmanstadt, and printed at the expense of the emperor Ferdinand I., under the care of Mofes and Widmanstadt, assisted by William Poitell. It was printed in Vienna in 1555; and in this edition the two left epistles of St. John, the second of St. Peter, the epistle of St. Jude, and the Revelation of St. John, are wanting. This edition princeps will ever retain its intrinsic value. Tremelius's edition at Geneva, in 1569, fol., is a copy of the former in Hebrew, and not in Syriac letters. The Antwerp edition in the fifth volume of the Bibli Regia is referred to the year 1571. There is another Antwerp edition in 6vo., in Hebrew letters without points, which may be considered as a supplement to the Hebrew bible printed by Platina in 1573 and 1574; and there are also an Antwerp edition in 10mo., and two other Antwerp editions printed in Syriac letters, the one in 1569, and the other in 1620. The Paris edition of 1584 contains the Greek text, the vulgate, and the Syriac version, with a Latin translation over each line, different from and less literal than that in the Antwerp Polyglot. Hutter, in 1599, inserted the Syriac version in his edition of the New Testament in twelve languages: the Cothon edition by M. Troiss, in 1621, 4to., is printed in Syriac letters, with a translation and a collection of various readings, printed by Walton in the fifth volume of the London Polyglot. L. de Dieu published the Revelation of St. John in 1637, at Leyden, and reprinted it in 1643, in Syriac and Hebrew letters. Pococke published at Leyden, in 1639, the four epistles wanting in the Old Testament.

All these parts of the Syriac New Testament were collected and published in the Paris Polyglot, in Syriac letters. The Latin translations by Gabriel Slonits, the editor of the Syriac Old and New Testament, are given very inaccurately. The next edition appeared in the London Polyglot, in which was added the story of the adulteress, from a MS. in the possession of archbishop Usher, but St. John, v. 7, is faithfully omitted. The edition of Aegidius Gathier, which appeared at Hamburg in 1664, is generally used in Germany. A Syriac New Testament was published in Hebrew letters without points at Sultzbach, in 1684, by Christian Kaoroe of Rolenroth, which Schaaf says is only a reimpresion of the Antwerp edition of Plantin above-mentioned. The very best edition of the Syriac New Testament, says Michaelis, is undoubtedly that of Leyden, published by Schaaf in 1708, and reprinted in 1717. The last Syriac version of the New Testament which we shall mention, was published at Leipzig in 1715, fol. in "Christiani Reineccii Biblia quadrilingua." A new edition, says Michaelis, corrected from the most authentic MSS., is still wanting.

The learned Bengelius conjectures, that possibly the Syriac version was not taken immediately or solely from the Greek, but that the translator also made use of the Latin version. But professor Michaelis thinks this conjecture to be in the highest degree improbable; as it is hardly credible that in Syria, where Greek was the current language in all the principal cities, a translator of the New Testament would have recourse to a Latin translation rather than the Greek original; and, besides, there is reason for believing that the Syriac version was made at Edessa, where the Latin language was probably unknown. The Syriac version coincides very much with the Latin, called the Vulgate, and with those ancient Greek MSS. which are undoubtedly written in the West. This wonderful harmony between the two most ancient versions of the New Testament, one of which was spread throughout Europe and the soils of Africa, and the other propagated from Edessa to China, could have had no other cause than a similarity of the Greek MSS. in the west of Europe, and the east of Asia, which must have deviated in an equal degree from the original text, and the MSS., in which was quoted the Greek edition. The similarity of the Greek MSS. from which the two most ancient versions were taken, can be ascribed to no other cause than their high antiquity. Let us, therefore, though not seldom, does the Syriac version agree with the Coptic, and with those ancient MSS. that belong to the Alexandrine edition, sometimes when their difference from those of the Western edition. This similarity will be also ascribed to the high antiquity of those MSS., whereas the copies of the Greek edition are of a later date. Hence it appears we cannot support the undoubted authority of the Syriac, the Coptic, and the Latin verse, by a quotation of Origen, and the ancient Greek MSS. of the Alexandrine and Western editions, is not only of great importance, but may in general be regarded a genuine.

The learned are much divided in their opinions regarding the antiquity of the Syriac version; some referring to the very earliest ages, and others taking all possible pains to prove it to be modern. Professor Michaelis is of opinion that it must have been made in the first century. It is indeed barely credible, as Cranmer, who was a convert to Christianity about the year 1645, that the Christian communities in those countries should have been deficient of a translation of the New Testament in their native language; and Melito, who lived about the year 170, expressly declared, that a Syriac version of the bible at that time existed. Manes also, in his disputes with the Christians of the East, quoted the New Testament, and the public reader of the Christians of Edessa, and could have read the New Testament only in Syriac; the question, therefore, is prior to the age of Manes. Besides, it appears from the testimony of Jerom, that the Syriac bible was in his time read publicly in the churches, for he says, Ephrem, the Syrian is held in such veneration, that in writings are read in several churches immediately after the lections from the bible. A very convincing argument in favour of the antiquity of the Pehuito, is its general reception among all the sects of the Syrian Christians, a circumstance which proves it to have been in general use before the Syriac church was divided into parties. Another argument in favour is the omission of several books, which were afterwards received by the Syrians. The manner likewise in which certain words and phrases are translated in the Syriac New Testament, affords also a presumption in favour of its antiquity. In the left place, Ephrem, who lived about the year of Christ 370, quotes the New Testament, according to the version now extant. From all these considerations we may conclude, that the Syriac version was made either at the end of the first or the beginning of the second century.

The objections that have been brought against this early date are examined and refuted by professor Michaelis.
Dr. Marsh, the editor of Michaelis's *Introduction to the New Testament*, has investigated the arguments in favour of the professor's opinion, and his answers to the objections against it; and he is satisfied neither with the one nor the other. The neccessity, says Marsh, of a Syrian translation in the first century is not so obvious as Michaelis contends; for in all the great cities of Syria, Greek was at that time the current language. The testimony of Melito is questioned, as none of his works exist, except a few fragments preferred by Eusebius in his Ecclesiastical History. His evidence for the antiquity of the Pehito rests on the authority of a scholion, ascribed indeed to Melito, but probably Ipurious, and written many years after his death; and if it were genuine, it would only avail to prove, that the Syrian version of the Pentateuch existed before the close of the second century. Again, Ohannes appears, on the authority of Beaufobre, erroneously cited by Michaelis, not to have been ignorant of Greek; and therefore the argument, founded on this supposition, falls to the ground. Marsh also disputes the conclusiveness of other arguments alleged to prove, that the Syrian version was made in the first century; and he says, that positive reasons may be advanced to show that the hypothesis is wholly ungrounded. No man could think of translating the Greek Testament, before its several parts were collected and united in one volume, or before the sacred canon was formed. But Griefbach and Semler have shown, that the canon was not formed before the middle of the second century. Previously to that period, therefore, the Syrian version cannot possibly have existed.

It cannot with certainty, or even probability, be determined who was the author of the Syrian version; for though the Syrians ascribe it sometimes to the evangelist St. Mark, and at other times to Thaddeus, called by them Adabus, their accounts are confirmed by no authorities. It has been the common opinion in Europe, though it was never supposed in Asia, that Antioch, where the disciples were first called Christians, is the place where the Syrian version was made. But this opinion, says Michaelis, is not only unfounded in historical evidence, but is highly improbable in itself, and proceeds from an ignorance of that country; for Greek being the current language in all the cities to the west of the Euphrates, and especially at Antioch, no motive could have existed for making a translation of the Greek Testament in that city. Although no tradition were till extant that it was written at Antioch; if it were, it would naturally occur as the most probable place; it being a city where the Christian religion was planted in the first century, was adopted by its sovereigns, who erected churches with all the magnificence of Heathen temples, was thence early and widely propagated in the eastern parts of Asia, and a city not only whole language was Syrian, but which during many ages was the eastern metropolis of the Christian world. Michaelis commends the Pehito as the best translation of the Greek Testament which he has ever read; its language being the most elegant and pure, not loaded with foreign words, like the Philonian version and other later writings; bearing no marks of the stiffness of a translation, but written with the ease and fluency of an original; and this excellence of style is ascribed to its antiquity, and to its having been written in a city that was the residence of Syrian kings.

The translation of the second epistle of St. Peter, the second and third of St. John, that of St. Jude, and the Revelation of St. John, is undoubtedly modern, but not made by the same person who translated into Syriac the rest of the New Testament. These books are not found in any MSS. of the Syrian Pehito; neither Nestorians nor Jacobites read in their churches the Revelation of St. John. It is not certain who was the translator of the revelation; the MS. from which L. de Dieu printed it belonged to Scaliger, and was brought from the peninsula of India on this side of the Ganges. Some have ascribed it to Maraba, or Mr. Abba, or Macrejan, who was primate of the East between the years 535 and 572, and translated the Old Testament from the Greek, though a translation had been already made.

The Syrian, or Philoehian version, was so called from Philoehius, otherwise denominated Xenayas, bishop of Hieropolis, or Makbug, from the year 488 to 518; but Philoehius was only patron of the work; the translator being Polycarp, his rural bishop, who executed the work in the year 508. Of this work it was only known, before the middle of the last century, that it existed; and the conjectures formed concerning it were all confused and uncertain. Thomas of Heraclea, a Monophysite, from whom this version is sometimes called Heraclean, undertook a critical correction of it, and made a journey to Alexandria for this purpose; and it was published there in the year 616. In style this version is much inferior to the Pehito; and it is less accurate.

Besides the Pehito and Philoehian versions, it is probable that there existed other Syrian versions, with which biblical critics are at present unacquainted. The Nestorian Christians, who inhabit the mountains of Syria, whose language differs in some respects from that of the more western Jacobites, and who pronounce the dialect of Aramean as we pronounce Chalced, have a peculiar version, which we call the Karkasite. Professor Adler found at Rome a valuable Syriac or rather Chaldean version of the New Testament, though it is only a lectionarium. The dialect of this MS., known in the Vatican by the name of Codex Vaticanus, is East Aramean or Chaldean. Allman, Bib. Orient. Michaelis on the New Testament, by Marth, vol. ii. vol. iii. ed. 2. 1802.

SYRIAC YEAR. See YEAR.

SYRIACUM MARIS, in Ancient Geography, a part of the Mediterranean sea, which bathed the coasts of Syria, according to Ptolemy.

SYRIACUS LAVIS, in Natural History, a name given by Aetius, and many other authors, to the petrified stones of the aethiopes, called by us the Jews-stones, and petrified Balsam from their likeness to an olive in shape, and called by the ancients tecolithus.

It has been a common opinion that this stone was good against the gravel and stone; but Aetius limits its efficacy to a particular case, which is that where the stone matter is lodged in the kidneys and ureters; but he frankly confesses it is of no power to dissolve or break the stone in the bladder.

This is contrary to the doctrine of Dioscorides, and the other old Greeks; but more consonant to reason and experience. Some have carried its virtue so far, as to pretend, that when rubbed to powder, and mixed in water, and that mixture rubbed on the groin and perineum, it will break the stones concreted within, and bring them away in pieces by urine. This, though too good for belief, is yet given us by Pline. In most of the common editions, the words stand thus, *lignentum frangit calculeus*; but all the best copies have it *ungrentum*; and the word *lignentum* is only made by dividing the two perpendicular lines in the letter L.

SYRIE PYLAE, in Ancient Geography, a defile at the eastern extremity of the Mediterranean sea, by which they passed
paffed from the gulf of Icus into Syria, situated at the extremity of one of the branches of mount Amanus.

SYRILIANES, in Geography, a tribe of Finns, who inhabited the district of Ustya Veliko, in the governments of Vologda, of Perme, and Tobolsk. These people call themselves, as well as the Pernians, among and near whom they dwell, Komu or Kodi-mart. Their language, which they have still preserved, much resembles the Pernian, and is not, according to de Gom, the Finnish, but the older of the Slavonic family of languages, and general manners, they have approached so near to the Russians, that they are scarcely any longer distinguishable. In the 14th century, they, together with the Pernians, were converted to Christianity. Tooke's Russia, vol. i.

SYRIAS, in Ancient Geography, a promontory of Asia, in Paplagonia, upon the bank of the Euxine Sea.

SYRICON, a word used by some authors in the same sense as faunus. Pliny makes it a composition of equal parts of sphinct and faunus; and Actius gives it as the name of a collyrium, used in many disorders of the eyes.

SYRINGA, in Botany, the Lilac, was so called by Linnaeus, from ςυρίγας, ςυρίγγος, a pipe, on account of the use which the Turks, according to Clusius, make of its straight and tubular branches, when deprived of their pith, for tobacco-pipes. In Bauhin's edition of Matthiolus, p. 854, it is recorded, on the authority of Cortus, that this tree is called in Barbary Springa; which De Theia writes firi, and suppofes to be the real source of the Linnean name. It may as well be imagined that this African word came from the Greek, and originated in the resemblance of the branches to a reed, which is likewise used for various economical purposes, as well as for the simplest, most ancient, musical instruments. We have no doubt indeed that Linnaeus had both words in view; for Syringa occurs in the edition of Matthiolus which he generally used, the smaller Valgrifian one, of 1770, though not in that with the large cuts, of 1568, where much valuable matter is omitted. The Philadephus of Linnaeus and others, now commonly called Syringa in the gardens, is confounded in its nomenclature and history with the above, its branches being capable of serving the same purpofes. See Syringa in Clusius and Gerarde.—Linn. Gen. 11. Schreb. 14. Wild. Sp. Pl. v. 1. 48. Mart. Mill. Dict. v. 4. Ait. Hort. Kew. v. 1. 23. Vahl Enum. v. 1. 38. Gaertn. t. 49. (Lilac); Tourn. t. 372. Juss. 103. Lamarck Illustr. t. 7;—Clafs and order, Diandria Monogynia. Nat. Ord. Sepiaria. Linn. Jaffirica. Jaff. 2.

Gen. Ch. Cal. Perianth inferior, small, tubular, of one leaf, permanent, bordered with four ereth teeth. Cov. of one petal, funnel-shaped; tube cylindrical, several times longer than the calyx; limb in four deep, elliptic-oblong, concave, obtuse, spreading, or somewhat revolute, segments. Stam. Filaments two, very short, inserted into the tube of the corolla; anthers somewhat funnelfhaped, obtuse, ereth, enclosed within the tube. Pftp. Germen superior, oblong; style thread-shaped, riling as high as the flamen; stigma cloven, turgid. Peric. Capsule oblong, pointed, compressed, of two cells and two valves, with a contrary, fixed, double partition; from the centre of each. Seeds two in each cell, oblong, compressed, pointed at each end, with a membranous border at each margin.


1. S. vulgaris. Common Lilac. Linn. Sp. Pl. 11. Willd. n. 1. Ait. n. 1. Curt. Mag. t. 183. (S. cerulea flore; Chuf. Hift. v. 1. 56. S. cerulea; Ger. Em. 1599. Lilac; Math. Valgr. v. 2. 576. L. vulgaris; Poiteau et Turpin Pl. Paris. 7. t. 5—Leaves ovate-heart-shaped. Stem arborescent.—Said to be a native of Persia. Dr. Linsdorff found this tree wild among the shaly rocks of Mount Hennas, but not in Greece, nor its immediate neighbourhood. The Turks appear to have long cultivated the Lilac, and its common. English name is derived from them, belonging also in their language to the Privet. The first Lilac introduced into the gardens of Germany, Holland, and England, about the middle of the 16th century, appears to have come from Constantinople. At present nothing more common, or more hardy, in every garden and shrubbery, even in the smoky courts of London and other great towns, nor does any thing contribute more to adorn the country about London, than this plant and the Laburnum, vior they blossom together in May. The Lilac rite to the height of a middle-sized tree, with opposite, round, smooth branches. Leaves opposite, deciduous, flaked, smooth, a tire, pointed, veiny, of a full opaque green, without stipules; their length from two to three inches; their base heart-shaped, somewhat decurrent along the linear channeled fott-fallck. Clusters terminal, a foot long, very dense, obtuse, repeatedly compounded, of innumerable highly fragrant flowers, whose scent is too powerful for most people in a confined apartment. The corolla varies in the breadth of its extremities, as well as their hue, the narrower often being of the peculiar pale purplish-blue, popularly denominated the colour; the broader kind is more purple. A pure white variety is common. Matthiolus is charged with having imported the oriental seed, called Ben nut, to his figure of the Lilac above cited. That he confined the two plants is certain, but it seems to us that his drawing might altogether have been taken from the Syringa. See Hyperanthesia, n. 2.

2. S. chinensis. Chinefes Lilac. Willd. n. 2. Bamm. 378. Vahl n. 2. Ait. n. 2.—Leaves ovate. Stem furby. Native of China. Hardy with us, flowering in May and June. Of a much humbler stature than the former, with ovate, not at all heart-shaped, leaves, and more lax panicles of rather larger flowers. It is generally taken for a broad-leaved variety of the following, and like them bears furby well.


4. S. jacquinta. Mill. t. 164. f. 2. " Schmidt. Arb. v. 2. t. 79." (Agem Lilag Perforum; Cornut Cassud. 186.—Leaves more or less pinnatifid. Native of Persia. Introduced into our gardens about 1640; Parkinson. It is now common, and quite hardy, flowering in May, and easily forced, so as to come much earlier. This is a shrub, of a slender habit, four or five feet high, with opposite, flaked, lanceolate, pointed, entire leaves, an inch and half long; occasionally becoming deeply pinnatifid, which variety is but little increased by layers. The flowers are larger than the Common Lilac, and equally fragrant, but fewer in each branche, and less coved. Their white variety is peculiarly brilliant and elegant. This species scarcely ever forms capsulae with us.


Syringa, in Gardening, contains plants of the deciduous flowering, shrubby kind, of which the species cultivated are the common lilac (S. vulgaris), and the Persian lilac (S. persica).

In the first sort there are several varieties: as with white flowers,
flowers, with blue flowers, with purple flowers, or Scotch lilac.

The second species has also several varieties: as the common purple-flowered, white-flowered, blue-flowered, and the laciniate or cut-leaved.

Method of Culture.—These plants are mostly raised by suckers or layers, and sometimes by seeds. The suckers should be taken off in the autumn or spring, with root-fibres to them, and be planted out either in nursery-rows, to remain a year or two, or where they are to remain. The layers may be made from the young plant shoots, and be laid down in the autumn, in the usual way, when in the autumn following they may be taken off and planted out, as in the suckers. The first layer may likewise be raised from seeds sown in a bed of common earth, in the autumn or spring, keeping the plants clean when they come up. They afford variety in the large borders and other parts of shruberies.

SYRINGA OF PAN. See SYRINX.

SYRINGE, formed from syrinx, syrinx, syrinx, an instrument serving to imitate, or suck, in a quantity of any fluid, and to squirt or expel the fame with violence.

The syringe is made of a hollow cylinder, as ABCD (Plate XV. Hydraulics, fig. 8.) furnished with a little tube at the bottom E F. In this cylinder is an embolus or piston K, made, or at least covered, with leather, or some other matter that easily imbibes moisture; and so filling the cavity of the cylinder, as that no air or water may pass between the one and the other.

If then, the little end of the tube F be put in water, and the embolus drawn up, the water will ascend into the cavity left by the embolus; and, upon thrusting back the embolus, it will be violently expelled again through the same tube E F: and still with the greater impetus will the water be expelled, and to the greater distance, as the embolus is thrust down with the greater force, or the greater velocity.

This ascent of the water the ancients, who supposed a plenum, attributed to nature's abhorrence of a vacuum: but the moderns more reasonably, as well as more intelligibly, attribute it to the pressure of the atmosphere on the surface of the fluid.

For, by drawing up the embolus, the air left in the cavity of the cylinder must be exceedingly rarefied; so that being no longer a counterbalance to the air incumbent on the surface of the fluid; that prevails, and forces the water through the little tube, up into the body of the syringe.

In effect, a syringe is only a single pump, and the water ascends in it on the same principle, as in the common sucking-pump; whence it follows that water will not be raised in a syringe to an height exceeding thirty-two or thirty-three feet.

Syringes are of considerable use in medicine and surgery. By them clysters are administered: injections of medicinal waters, &c. made into wounds, &c. They also serve to inject coloured liquors, melted wax, &c. into the vesicles of the parts of animals, to shew the disposition, texture, ramifications, &c. of them.

The syringe is an instrument, that is used both in the rarefation and condensation of air. In order to understand its use in both these respects, it will be proper to explain the construction of its embolus or piston. ABCD (fig. 9.) represents a small cylinder of brass about one-fourth of an inch thick, and of such a diameter as just to move up and down in the syringe without interruption, but so close as not to admit a thin paper between it and the syringe. It has a screw at the top and bottom of the fame bigines, and of the same thread, but with this difference, that at the end C, a piece of bladder is tied on, which makes a valve, so fixed as to suffer all the air coming in the direction D C to pass by, but to stop all that endeavours to pass from C to D. The rod of the syringe, whose end is represented at R (fig. 10.), has a piece like a bell, PP H, with small holes through its upper part, and a female screw at bottom, to receive the end D of the screw of fig. 9. That piece being screwed in, as represented by the small letters a b c, must be another cylindrical piece g g, whose diameter is about one-fifth of an inch smaller than the other screwed on to c or c, serving for two uses, the one to preserve the valve at C, from being damaged against the bottom of the syringe by its thickness, and the other, (which is its principal use,) to press a soft oiled leather f f against a b. This leather will never fold upwards for want of room between A B and the sides of the syringe, but will spread against them and A B, so as to drive all the air before it. (which air is also hindered by the valve at c) forward through the nozzle in the syringe into any place where it is intended to be driven. But when the rod is driven in, as the leather f f folds easily about the smaller cylindrical plate g g, the air will easily pass by to fill the syringe that way, as well as through the valve in the direction d c. When the syringe is made use of for sucking, you must only invert the piece A B C D, so as to screw the end C with its valve into the bell P P, with the soft oiled leather f f between: and then the reverse will happen of what has been just mentioned; for then in driving down the piston, the air from any vessel coming into the syringe will slip in the direction a l b l, between the bell and sides of the syringe (the leather f f not being on now), and also through the valve-piece, and the holes near P P: but in drawing up, the valve will shut, and the leather f f will apply close to a b, so as to admit of no external air to go back into the syringe. In both cases, whether of injecting or exhausting air, such a double screw as A B C D (fig. 9.) with its valve is to be used; but with the valve towards the rod in sucking; and the other way in forcing, that no air injected into any thing may return into the syringe. De la Faye, Exp. Phil. vol. ii. p. 393.

Since the discovery lately made, as it is said, by a soldier in the French army, that light and heat are produced merely by the compresion of atmospheric air, the principle has been applied to practical purposes. Accordingly it has been found, that by adapting a moveable air-tight cap to the bottom of a common syringe, and placing within it a small piece of common tinder, and then depressing the piston with a sharp, quick action, heat will be produced sufficient to inflame the tinder. The use of the screw-cap at the end of the syringe is not only to render the instrument air-tight, but to serve for receiving the tinder or fungus placed within it. Syringes of this kind are fold by most of the philosophical instrument makers in London. Since this contrivance has been thought of, it has been proposed to make walking-sticks, furnished with similar syringes, so adapted to them, that a single stroke of the walking-stick on the ground would be sufficient to inflame the tinder, and to afford sufficient light to the person who used it in any emergency.

SYRINGE, DREW in Gardening; a fine sort of syringe, contrived for the purpose of throwing the water in a dewy manner over different fine sorts of fruit-trees. In shade-bound peach and nectarine trees, after being hard forced, the use of earth or clay paint, whenever they are pruned or tied in, will, it is said, be attended with admirable effects, especially when the dew-syringe is freely used soon after the fires are set a going, and the hose shut in: as by retaining the dewy moisture upon the bark and buds of the trees, it nourishes
SYR.

nourishes them both, makes the flowers much stronger, the fruit sets much thicker, and keeps the trees free from insects, when they are in a state most liable to be injured by them. Indeed the writer has confidently affirm, that these sorts of trees, when managed in this way with the syringing and painting, will seldom be either hide-bound or attacked by insects. The dew-syringe should of course be in every hot-house, as it is a necessary and very useful tool in all such situations and places, as well as on some other occasions.

It may also be of utility in the cultivation of some particular sorts of plants.

SYRINGITIS, a stone mentioned by Pliny, and described as being always full of cavities. Some have supposed this author meant the oboconilla by this name; but it is more probable that he meant the stone we now call fy-ringoids, or the pipe-stone.

SYRINGOIDES LAPIS, the pipe-stone, in Natural History, the name of a very beautiful foliate substance, of which there are several different kinds. The tubuli marini, or cafes of sea-worms, lodged in any solid substance of the foliate kind, constitute what is called the lapis syringoides.

The most frequent kind is made of the common matter of the ludus Helmuti, or sepias, with tubuli of different kinds and dimensions in it; but the most beautiful is that made of the bottom ofships, old boards, or piles, which, having been long in the sea, have been pierced by the sea-worms, which have made their several burrows, and left their shells behind them: the whole of these substances becoming afterwards petrified, is found in form of wood, with all the knots, veins, and other characters, but wholly of the hardness of stone. This is usually of a blackish colour, and the pipes being of a pale yellow, the whole makes a very elegant appearance.

Our clay-pits about London afford also a syringoides of this kind, but the earth there abounding with the matter of the common vitriolic pyrites, that substance by degrees gets into the pores of the wood, and the whole seems a mass of pyrites, with these pipes lodged in it in different directions. This has been called by authors pyrites syringoides.

Hill.

SYRINGOTOMUM, in Surgery, an old instrument for operating on fistula in ano.

SYRINGOTOMY, a term used for the cutting for the fistula.

SYRIX, Gr.; Fijita Pana, Lat.; Siringa, Ital.; Pan's Pipes, Eng.; an instrument composed of reeds of different lengths, tied or fastened together with wax, laid by the poets to be invented by Pan; and with respect to the syringa Pana of the ancients, it is observed by the editors of the Supplement to the first folio edition of the Encyclopaedia, that Bartholinus, De Tribus Vet. I. iii. c. 6. has related his having seen at Rome, on a monument in the Farnese palace, a syrinx with eleven pipes: the five first are of equal length, and consequently produce the same tone; with six others of equal diameter, but of different lengths from the first five. "I confess," says the author of the article, "that I am unable to conceive the use of the five first reeds or pipes of the fame length, for no two of them could be made to sound at once. If it not possible that these five pipes were half tones, and differed from each other in length, so little, as to seem all of a length; or, perhaps, they differed in diameter, and may have all produced different tones, though of equal length."

It is not a very sagacious conjecture to imagine that any ancient instrument had five semi-tones de fata. The chromatic tetrachord consisted only of one semitone major, one minor, and a minor third. We saw the syrinx mentioned by the encyclopedist at Rome, and had a drawing made of it; but reflecting on its absurdity afterwards, we made no use of it, and we have long seen that there is no truth in painters or sculptors for accurate drawings of ancient instruments of music. We have feet the syrinx, which had regular series of sounds, ascending or descending, representing four of one length, and three of another; which if course would furnish no more than two different sounds. Now the reeds that were joined together decreed is the proportion; at the top, where they received the breath, they were all of the same height; but at the bottom, where the breath escaped from the tube, they were all gradually shorter, one than the other. The cymbals, too, which were to be struck against each other, are placed in the hands of some antique figures in such a manner, that it would be impossible to bring them in contact with the necessary degree of force, without amputating, or at least violently bruising, the thumbs of the performer.

The manner of playing on the syrinx by the ancients under the title of fijita panis, is accurately described a single verse of Lucretius, lib. v.

"et supra calamos unco percurre labro."

Bianchini (De Tribus Gen. Instrum. Mus. Vet.) says the syrinx is the origin of the organ.

Bonanni (Gabinetto Armonico) calls the syrinx ciaja pfetoralis, the shepherd's whistles.

The two sets of admirable performers on Pan's pipes, at present, (1803) exalted the syrinx into a concert instrument in the open air; which is beating the ancients with their own weapons; for besides playing in different parts, they perform prettier airs, we believe, than the ancients ever heard on these rustic instruments. They have extended the scale beyond the ancient syrinx perifatum, maximum insitutum.

SYRIS, in Ancient Geography. See SIRIS.

SYRITES, in Natural History, a name used by Some for the sapphire; but by Pliny for a stone, which he says was generated in the bladder of a wolf.

SYRITTY, in Geography, a town of Bengal; 8 mays S.W. of Gorgot.

SYRIUS, a word used by some authors for a very shrill purge, a preparation of leoncy: being no other than a medicine for the ague or malady of that drug.

SYRMA, among the Greeks, a servant, or a long garment, common to both sexes, that reached to the ground. It was used in tragedies, that the perfons of the heroes and heroines might appear the taller. Pitif. in voc.

SYRMÆA, a name given by the ancients in general to a certain root, said to be of the radish-kind, and to be frequently used to promote vomiting.

Some have made it also the name of a sort of viand, prepared of honey, the fine fat of animals, and other ingredients, which was the prize bestowed at one of the Sparta games; others have used it to express a purging potion, made of salt and water, or plain brine. The Egyptians frequently purged themselves with this radish-juice and drachm, which operated gently both upwards and downwards, and these potions were called by the name name fomæus.

SYRMÆUS, a word used for a description of the games at Sparta, the prize in which was stymus, or a mixture of fat and honey.

SYRMÆUS, a word used by the ancient medical writers to express a gentle purging of the bowels, either by food or vomit, it had its name from smus, a word expressing a medicine that acted in this gentle manner.

SYRUS,
SYROS, in Ancient Geography, one of the Cyclades islands, situated S.W. of the island of Tenos, S. of that of Andros, W. of Delos, and N.W. of Paros, celebrated for its power and commerce; now Syros, which see.—Alfo, a town of the same island.—Alfo, a town of Afa Minor, in Asia.—Alfo, a river of the Peloponnesus, in Arcadia.

SYRTOS, an island situated between Sicily and the coast of Africa.

SYRTES, two gulfs on the northern coast of Africa, one called "Syrtis minor," on the coast of Byzantium; the other called "Syrtis," or "Syrtis major," on the coast of Cyrenaica, near the gulf of Sydras. The appellation "Syrtis," with a more accurate etymology, seems to be derived from the Greek σαρῶν, στραχων, and the reason is sufficiently known to those who frequent this coast, the sea continually tending to enter into these Syrtes and the adjacent coast, so that vessels are borne with it, and exposed to great danger of being lost among the rocks.


SYRYP, SYRUPUS, or SYRUPUS, in Pharmacy, an agreeable liquor, or composition of a thick consistence, made of juices, tinctures, or waters, of fruits, flowers, or herbs, boiled up, in order to preserve it from spoiling, by fermentation, or otherwise, with a more or less etherial essence, tincture, or essence, of the same bodies. Menage deriveth the word from the Arabic, صفراب, potish; formed from the root صفراب, to drink. Others derive it from the Greek σεραβος, I draw; and σεραβος, juice. Ethmus, from σεραβος, in regard these kinds of liquors were much in use among the Syrians, a very delicate people.

According to D'Herbelot, the words syrup, and sirab, or sorbat, do both come from the Arabic sirabah, which signifies any kind of drink in the general.

There are various kinds of syrups denominated from the various fruits and waters, before boiled, and from, or on their virtues; as syrup of violets, of elder, of wormwood, of poppies, &c. emetic syrups, lyeentic, and anti-nephritic syrups, and chologogue, phlegmagogue syrups, &c.

Syrups, which were formerly looked upon as medicines of considerable value, are at present regarded chiefly as vehicles for medicines of greater efficacy, and are used for sweetening of draughts, juleps, or mixtures, and for reducing the lighter powders into boluses, pills, and electuates. But as all these purposes may be answered by the simple syrup alone, there is little occasion for any other.

There seems to be no part of pharmacy in which the writers of dispensatories have more erred than in their directions about the making of syrups; which feints the more strange, because this part is particularly easy.

The whole business of syrup-making may be, however, reduced to a few short and easy rules. At first, it is matter of experience that aqueous infusions, decoctions, or other aqueous liquors, require twice their own weight of dry sugar-candy to make them into a syrup of a jiffy consistence, for keeping without candying or fermenting.

This rule, by directing the use of sugar-candy, fixes the consistence of syrups in an exact manner than any other else, because all fats require a determinate proportion of water in crystallizing; so that sugar, in the form of candy, contains always one certain proportion of water, while different kinds of sugar may hold more or less aqueous matter, according to their different manner of refining, the accidents of the weather, &c. Hence, therefore, all such infusions for syrups as are of a delicate or delectable colour, which is impaired by boiling, such as violets, clove-July flowers, &c. and all such infusions as contain any volatile parts, which would evaporate by a boiling heat, such as those of cinnamon, orange-peel, &c. should have twice their own weight of sugar added to them, and be kept close covered in the gentle heat of the balneum Mariae, till the sugar is dissolved; which, to attain the solution, should be twice the quantity.

Secondly, the decoctions of all such vegetable substances as lose no valuable parts by boiling, may be boiled down to the proper consistence with their own weight of sugar, the two being first clarified together with the whites of eggs in the usual way: but if the ingredients here contain any unctuous or balastic parts, on which their medicinal virtue depends, let the sugar be added from the very first, and boiled along with the ingredients; afterwards straining and clarifying it, before it be near the consistence of a syrup. This is founded on the property in sugar of dissolving resins and oils, so as to make them intimately mix with water.

Thirdly, all vegetable juices are to be thoroughly purified, before they are boiled into syrups. Thus the juices of lemons, oranges, &c. are first to be filtered, and then made into syrups without boiling, according to the first rule; but the juices of mulberries, and the like, will not clarify without a beginning fermentation; wherefore they must first stand a day or two, and then they will pass through a funnel; after which these are to be made into syrups and waters, &c. with an eighth part or other of the quantity of sugar that is, with one pound twelve ounces of sugar to a pint of the juice, on account of their being somewhat saccharine themselves. And wines and vinegars must be made into syrups with the same quantity. Shaw's Lectures, p. 205.

In making syrups, refined sugar should always be employed; or, if coarser sugar be used, the syrup should be clarified, by beating to a froth the white of eggs with a small portion of water, and adding it to the solution of sugar and water before boiling. The above mentioned as the syrup boils, and involving the impurities which the sugar contained, rises to the surface in the form of a scum, which must be carefully removed. If too much sugar be used, or if the syrup be too long boiled, the sugar soon crystallizes; and if it be in too small proportion, the syrup quickly ferments, and becomes accecent. The most certain test of the proper consistence of a syrup is its specific gravity, which, when cold, should be 1.385. But, however well prepared, syrups are apt to ferment, when kept in a temperature above 60°; and therefore the following direction relative to their preservation is given by the London College.

"Let syrups be preferred in a place the temperature of which never exceeds 55°."

SYRUP of Londo. Ph. is obtained by dissolving 21 lbs. of refined sugar in a pint of water, by means of a water-bath; setting it aside for 24 hours, taking off the scum, and if it has any faces, pouring off the clear part from them.

The simple or common syrup of the Edinb. Ph., is prepared by dissolving 15 parts of refined sugar powdered in eight parts of water by a gentle heat; and boiling it a little so as to form a syrup. Syrups, for which neither the weight of sugar nor the mode of dissolving it is specified, are thus prepared.
prepared; add 20 oz. of refined sugar, finely powdered by degrees, to one pint of the liquor preferred; and digest with a moderate heat, in a clove vessel, till it is dissolved, frequently stirring it; let the solution stand for 4½ hours, take off the scum, and pour off the syrup from the faces, if there be any. Simple syrup, properly prepared, should be inodorous, sweet, thickish, nearly colourless, and perfectly transparent.

Syrupus Acidis Aetigh, syrup of acetic acid, of Edinb. Ph., is prepared by boiling 3½ lbs. of refined sugar in 2½ lbs. of distilled vinegar, so as to form a syrup; as it is apt to be decomposed, it should be made in small quantities at a time. This syrup may be used for sweetening barley-water or gruels, in fevers and inflammatory diseases.

Syrupus Allii, syrup of garlic, of the Dub. Ph., is obtained by macerating one pound of garlic-root (bulb) in two pints of boiling water, in a covered vessel, for 12 hours; then adding the sugar to the strained liquor, and thus forming a syrup. This, though disagreeable, contains the virtues of garlic.

Syrupus Albae officinalis, syrup of marsh-mallows, of the Edinb. Ph., is procured by boiling 10 lbs. of water with one pound of fresh root of marsh-mallows sliced, down to one-half, and expressing it strongly, and straining; putting aside the strained liquor, and when the faces have subsided, adding 4 lbs. of sugar, then boiling it so as to form a syrup. This syrup is supposed to possess demulcent properties, which are trivial; and as it contains a small proportion of sugar, it is soon spontaneously decomposed. The lubricating virtues of this syrup may be supplied by adding to the common syrup a sufficient quantity of mucilage of gum arabic.

Syrupus Aurantis, syrup of orange, of the Lond. Ph., is prepared by macerating 2 oz. of fresh orange-peel in a pint of boiling water for 12 hours, in a covered vessel; then pouring off the liquor, and adding to it 3 lbs. of refined sugar.

Syrupus Citri Aurantis, syrup of orange, of the Edinb. Ph., is obtained by macerating 6 oz. of fresh peel of Seville oranges in 3 lbs. of boiling water for 12 hours; then adding 4 lbs. of refined sugar in powder to the strained liquor, and expelling it to a gentle heat, so as to form a syrup.

Syrupus Aurantis, syrup of orange, of the Dub. Ph., is had by macerating 8 oz. of fresh peel of Seville oranges in six pints of boiling water, for 12 hours, in a covered vessel, and diffusing as much sugar in the filtered liquor as will form a syrup.

A syrup equally agreeable and efficacious may be made by adding $\frac{1}{3}$ of tincture of orange-peel to a pint of simple syrup.

Syrupus Colchici Autumnalis, syrup of meadow-saffron, of the Edinb. Ph., may be made by macerating 1 oz. of fresh meadow saffron-root (bulb), cut into thin slices, in 16 oz. of distilled vinegar, for two days, shaking the vessel occasionally; then expressing and gently straining the liquor, and adding to it 3½ oz. of refined sugar in powder; and then boiling a little, so as to form a syrup. With the sublimation of syrup for honey, this preparation is similar to oxymel; and the dose is $\frac{1}{3}$ of a tumbler, increased gradually to $\frac{1}{2}$ or more.

Syrupus Croci, syrup of saffron. See Saffron.

Syrupus Dianthi Caryophylli, syrup of the clove-July flower, of the Edinb. Ph., is obtained by macerating 1 lb. of recent petals of the flower, freed from their claws, in 4 lbs. of boiling water for 12 hours, then adding 7 lbs. of refined sugar in powder to the strained liquor; and diffusing it with a gentle heat, so as to form a syrup.

Syrupus Caryophylli Rubri, syrup of clove-July flower, of Dub. Ph., is prepared by macerating for 12 hours, 2 lbs. of the fresh petals, freed from the claws, in six pints of boiling water, in a glazed vessel; and diffusing a sufficient quantity of sugar in the strained liquor to make a syrup. This syrup is valued for the rich colour and agreeable flavour of the flowers. Alkalies change the colour to green, and thus form a tinct of the genuineness of the syrup.

Syrupus Limonis, syrup of lemon, of the Lond. Ph., is made by diffusing 2 lbs. of refined sugar in a pint of strained lemon-juice.

Syrupus Citri Medicae, olim Syrupus Limonum, syrup of lemons, of the Edinb. Ph., is prepared by diffusing three parts of refined sugar in three parts of strained lemon-juice, after the faces have subsided, so as to form a syrup.

Syrupus Limonis, syrup of lemon, of the Dub. Ph., is made by putting two pints of expressed lemon-juice, after the faces have subsided, into a matrass, and immersing it in boiling water for a quarter of an hour; straining it through a sieve when cold, and making it into a syrup. This is an agreeable syrup for acidulating barley-water or other drinks in febrile diseases: it is also a useful adjunct for gargles in inflammatory fore-throat.

Syrupus Mori, syrup of mulberry, of the Lond. Ph., is made by diffusing 2 lbs. of refined sugar in a pint of strained mulberry juice, as for syrup. This is used for the same purposes as the syrup of lemons, and has a better colour.

Syrupus Opii, syrup of opium, of the Dub. Ph., is obtained by macerating 18 grains of the watery extract of opium in 8 oz. of boiling water, till the opium be dissolved, and then adding sugar, so as to make a syrup. This is a useful astringent for allaying the irritation which occurs cough in catarrh after the inflammatory symptoms are abated, and for procuring sleep, in the diseases of children.

Syrupus Pappionis, syrup of poppy. See Pap.

Syrupus Pectoralis, syrup pectoral, a form of medicine prescribed in the late Lond. Ph., and intended to find the place of the syrup of maiden-hair, and some others of that kind. It is to be made thus: take leaves of Equisetum maiden-hair dried five ounces, liquorice four ounces, boiling water five pints; steep the ingredients for four hours, and afterwards strain off the liquor; and when it is made thus by settling, add to it the necessary quantity of sugar to make it a syrup in the common way.

Syrupus Rhamnus, syrup of buckthorn, of the Lond. Ph., is prepared by setting apart four pints of the fresh juice of buckthorn berries for three days, that the faces may subside, and straining it: adding to the strained juice peper-root sliced, and pimento berries bruised, of each half an ounce; then macerating in a gentle heat for four hours and straining; boiling the remainder of the juice down to 2½ pints, mixing the liquors, and adding 3½ lbs. of refined sugar, so as to make a syrup. This is a brisk cathartic; but on account of the roughness of its operation, it is seldom used, except as a horrid medicine. The dose is from $\frac{1}{3}$ to $\frac{1}{2}$, drinking freely of tepid demulcent fluid during its operation. See Rhamnus.

Syrupus Rossii, syrup of rose. See Rose.

Syrupus Saporis, is an ancient medicament, the bane of which is apples, with juices of bugloa, anise, saffron, &c. Thus called from Sapor, king of Persia, who overcame the enemy.
SYSTASIS properly only denotes the confidence of any thing, as of a syrup or ointment; but authors have used it also in a different sense. Hippocrates understands by it a collection of humours about the palate; and sometimes expresses by it a contraction of any part of the body from an uneasiness, or sensation of pain.

SYSTEM, SYSTEMA, formed from σύστημα, composition, in the general denotes an assemblage or chain of principles and conclusions; or the whole of any doctrine, the several parts of which are bound together, and follow or depend on each other.

In this sense we say, a system of philosophy; a system of motions, system of fevers, &c. Divines have framed abundance of systems of grace; the system of intermediate science, and predetermination, are invented to explain that of grace.

Descartes's system is held destructive to religion. Gafendus renewed the ancient system of atoms; which was that of Democritus, followed by Epicurus, Lucretius, &c.; Sir Isaac Newton's doctrine of colours, M. Leibnitz's metaphysica, and some discourses of M. Jullié, in the Academy of Sciences, to show that there are bodies whose parts are made to be destroyed by any natural agents, are very favourable to the system of Gafendus.

Experiments and observations are the materials of systems: an infinity is required to build one.

System, in ASTRONOMY, denotes an hypothesis or supposition of a certain order and arrangement of the several parts of the universe; by which astronomers explain all the phenomena or appearances of the heavenly bodies, their motions, changes, &c.

This is more peculiarly called the system of the world, and sometimes the solar system.

System and hypothesis have much the same signification; unless, perhaps, hypothesis be a more particular system; and system a mere general hypothesis.

Some late authors, indeed, furnish another distinction; an hypothesis, say they, is a mere supposition or fiction; founded rather on imagination than reason; a system is only built on the firmest ground, and ruled by the severest rules: it is founded on astronomical observations and physical caufts, and confirmed by geometrical demonstrations.

The most celebrated systems of the world are, the PILOTMAGA and the COPERNICUS; to which may be added the EGYPTIANS and TUSCONE: the economy of each of which is as follows.

SYSTEM, PILOTMAGA, places the earth at the centre of the universe; and makes the heavens revolve round the same from east to west, and carry all the heavenly bodies, stars, and planets, along with them in twenty-four hours.

For the order, distances, &c. of the several bodies in this system, see PILOTMAGA, p. 14, in which A exhibits Pilotmagna's arrangement, and B that adopted by some other astronomers.

The principal asserter of this system are Aristotle, Hipparchus, Pilomag, and many of the old philosophers, followed by the whole world, for a great number of ages, and long adhered to in divers universities, and other places, whence free philosophizing was excluded; but the late improvements have put it out of all countenance; and we do not want even demonstration against it.

SYSTEM, COPERNICUS. See COPERNICUS System.
SYSTEM.

The planetary system, described under Copernican, is the most ancient in the world. It was the first, that we know of, introduced into Greece and Italy by Pythagoras; whence, for many ages, it was called the Pythagorean system. It is conjectured that he was acquainted with the diurnal and annual motions of the earth; but he did not publicly profess the true system of the world. This, it is said, was taught after his death by Philolaus, about the year 450 B.C. as well as by Nicetas, Plato, Archimedes, &c. but lost under the reign of the Peripatetic philosophy; till happily retrieved, above two hundred years ago, by Nic. Copernicus; whence its new appellation of Copernican system. For the economy of this system, see the scheme of it, Plate XX. Afrom. fig. 15.

System, Egyptian, was that which was taught by the Egyptians, who had the merit of discovering that Mercury and Venus revolve round the sun, and not round the earth, as it had probably been before believed: they did not, however, suppose the fame of the superior planets. See this scheme exhibited in Plate XX. Afrom. fig. 16.

System, Tychoic, was taught by Tycho Brahe, a noble Dane, who was born A.D. 1546. It supposed the earth to be fixed in the centre of the universe or firmament of stars, and that all the stars and planets revolve round the earth in twenty-four hours; but it differs from the Ptolemaic system, as it not only allows a menstrual motion to the moon round the earth, and that of the satellites about Jupiter and Saturn in their proper periods, but it makes the sun to be the centre of the orbits of Mercury, Venus, Mars, Jupiter, and Saturn, in which they are carried round the earth in their respective years; as the sun revolves round the earth in a solar year; and all these planets, together with the sun, are supposed to revolve round the earth in twenty-four hours. This hypothesis was so embarrased and perplexed, that few persons embraced it. It was afterwards altered by Longomontanus and others, who allowed the diurnal motion of the earth on its own axis, but denied its annual motion round the sun. This hypothesis, partly true and partly false, is called the Semi-Tychonic system. For the order and economy of the Tychonic system, see the scheme in Plate XX. Afrom. fig. 17.

System, Solar, or Planetary, is that which was taught by Philolaus, &c. if not by Pythagoras, revived by Copernicus (see his article), and established on an immovable foundation by Sir Isaac Newton. This is restricted to our sun, together with the planets and comets that move round him at various distances and in various periods, and occupy a limited sphere in the immensity of space, though its limits are unknown; the stars, by their hitherto unmeasurable distance, and the little relation which they seem to have to us, being reputed no part of this system. It is highly probable, however, as we have elsewhere shewn, that each fixed star is itself a sun, and the centre of a particular system, encompassed by a number of planets, &c., which, in different periods and at different distances, perform their courses round their respective suns, and are enlightened, warmed, and cherished by them: hence we are led to entertain a very magnificent idea of the world; and hence also arise the ideas of system of systems. The reader will find an ample account of this system, and of the bodies that compose it, under Comet, particularly Planet, Satellites, Sun, and Stars; and also under the appropriate names of each planet.

For a general view of the solar system, we refer to Plate II. Afromasy. and for another view of it, to Plate XII. Afromasy. fig. 1. This last cited figure comprehends the orbits of all the principal planets, and of three of the comets. The parts of the orbits represented by entire lines are set north of the ecliptic, and the dotted parts on the south; the letters A and P denote the aphelion and perihelion. The point in the centre, which ought to be only 16.66 of an inch in diameter, represents the sun. The figures of the respective planets shew their comparative magnitudes, but the sun being represented by the innermost of the graduated circles which inclose the whole: they are placed according to their actual positions on the 14th of June, 1706. The letters M D shew the mean distance of the comet of 1750, being placed at the extremity of the leper and the ellipse in which it must be supposed to revolve.

The periodical times of the different planets are represented in Plate XXI. Afromasy. fig. 2. by lines of different lengths. The comparative velocities of the different planets are represented in fig. 3. by lines which shew the number of English miles described in a second, on the scale marked the lowest line: and the places of the ascending nodes of all the planets are marked in fig. 4. on one half of the ellipse; supposed to be extended in a right line; together with the inclination of their orbits. The line marked E E E shews the situation of the fixed ecliptic.

The annexed table shews the elements of the solar system.
### System.

#### Tabular View of the Solar System.

<table>
<thead>
<tr>
<th>Names of the Planets</th>
<th>Mean diameter in English miles</th>
<th>Mean distances from the Sun, in round numbers of miles</th>
<th>The correct mean distances, that of the Earth being 100,000</th>
<th>Mean apparent diameters, as seen from the Earth.</th>
<th>Mean diameters, as seen from the Sun.</th>
<th>Denities, that of water being 1.</th>
<th>Proportional quantities of matter.</th>
<th>Diurnal rotations round their own axes.</th>
<th>Inclinations of axes to orbits.</th>
<th>Inclinations of orbs to the ecliptic in 1780.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Sun</td>
<td>883,246</td>
<td>37,000,000</td>
<td>38,710</td>
<td>33 1.5</td>
<td>4 1/2</td>
<td>0.1654</td>
<td>0.8899</td>
<td>0.025</td>
<td>5 9 3</td>
<td>82 44 0</td>
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<td>37,000,000</td>
<td>38,710</td>
<td>10 16</td>
<td>9/2</td>
<td>5 23 35</td>
<td>7 0 0</td>
<td>5 9 3</td>
<td>3 23 35</td>
<td>82 44 0</td>
</tr>
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<td>68,000,000</td>
<td>73,333</td>
<td>58 30</td>
<td>5/2</td>
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<td>7 0 0</td>
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<td>4 8</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>66 32</td>
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<td>31 8</td>
<td>4 8</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>66 32</td>
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<td>27 10</td>
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<td>59 22</td>
<td>1 51 0</td>
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<td>1/2</td>
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<td>2 10 40</td>
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<tr>
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<td>1024</td>
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<td>166,000</td>
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<td>6/2</td>
<td>2</td>
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<td>2</td>
<td>2</td>
<td>2 10 40</td>
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<tr>
<td>Juno</td>
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<td>3/2</td>
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<td>3 10 40</td>
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<tr>
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<td>225,000,000</td>
<td>237,300</td>
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<td>3</td>
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<td>954,072</td>
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#### Table continued.

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<th>Tropical Revolutions</th>
<th>Sidereal Revolutions</th>
<th>Place of Apheleon in January 1800</th>
<th>Motion of the Apheleon in 100 Years</th>
<th>Longitude of Ascending Node in 1780</th>
<th>Moles of Nodes in 100 Years</th>
<th>Eccentricities, the mean Diameters being 100,000</th>
<th>Greatest Equator of Centre</th>
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<tr>
<td>Juno</td>
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<td>Vejeta</td>
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<td>Georgium Sidus</td>
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<td>30737 18 0</td>
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<td>11 29 17 47 0 1 44 35 90 80 42 5 27 16</td>
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</tr>
</tbody>
</table>

Height of the Atmospheres of the New Planets, according to Schroeter.
- **Ceres**: 675 English miles
- **Pallas**: 488 English miles
**SYSTEM.**

**ELEMENTS OF THE SOLAR SYSTEM.**

The sun, \( \odot \), revolves on his axis in 25.610.\(^{\circ}\). The inclination of his equator is 7\(^{\circ}\) 20\(\prime\). The place of its ascending node, \( \odot \), 2\(^{\circ}\) 18\(\prime\), or 7\(^{\circ}\) from the equinoctial point Aries. His diameter is 885,000 English miles, and his density, to use of the earth, as 155 to 1. His mean apparent diameter is 31\(\frac{1}{2}\) 57\(\prime\), his mean parallax 88.75.

<table>
<thead>
<tr>
<th>Mercury ( \oplus )</th>
<th>Venus ( \oplus )</th>
<th>Earth ( \odot )</th>
<th>Mars ( \oplus )</th>
<th>June ( \oplus )</th>
<th>Pallas ( \oplus )</th>
<th>Ceres ( \odot )</th>
<th>Jupiter ( \odot )</th>
<th>Saturn ( \odot )</th>
<th>Geopen ( \odot )</th>
</tr>
</thead>
</table>

**INCLINATION OF THE ORBIT.**

| \( 7^{\circ} \) | \( 3^{\circ} 24^\prime \) | \( 1^{\circ} 51^\prime \) | \( 13^{\circ} 4^\prime \) | \( 34^{\circ} 38^\prime \) | \( 10^{\circ} 38^\prime \) | \( 1^{\circ} 19^\prime \) | \( 2^{\circ} 30^\prime \) | \( 4^\prime \) |

**PLACE OF THE ASCENDING NODE.**

| \( 1^{\circ} 15^{\circ} 58^\prime \) | \( 2^{\circ} 14^{\circ} 58^\prime \) | \( 1^{\circ} 18^{\circ} 2^\prime \) | \( 5^{\circ} 21^{\circ} 4^\prime \) | \( 5^{\circ} 22^{\circ} 31^\prime \) | \( 2^{\circ} 21^{\circ} 7^\prime \) | \( 3^{\circ} 8^{\circ} 25^\prime \) | \( 3^{\circ} 21^{\circ} 57^\prime \) | \( 2^{\circ} 12^{\circ} 5^\prime \) |

**MEAN DISTANCE.**

\[
\begin{align*}
738.1 & | 723.3 & | 10000 & | 15237 & | 26640 & | 27650 & | 27670 & | 52028 & | 95497 & | 191836 \\[1em
795 & | 50 & | 168 & | 1418 & | 6770 & | 6800 & | 2170 & | 2501 & | 5364 & | 895 \[1em
\end{align*}
\]

**ECCENTRICITY.**

\[
\begin{align*}
37 & | 68 & | 95 & | 144 & | 253 & | 263 & | 263 & | 490 & | 900 & | 1800 \[1em
\end{align*}
\]

**MEAN DISTANCE IN MILLIONS OF MILES.**

**PLACE OF THE APHELION.**

\[
\begin{align*}
8^{\circ} 14^{\circ} 22^\prime & | 10^{\circ} 8^{\circ} 37^\prime & | 9^{\circ} 9^{\circ} 30^\prime & | 5^{\circ} 2^{\circ} 25^\prime & | 7^{\circ} 25^{\circ} 11^\prime & | 10^{\circ} 1^{\circ} 3^\prime & | 10^{\circ} 22^\prime & | 6^{\circ} 11^{\circ} 9^\prime & | 8^{\circ} 29^{\circ} 5^\prime & | 11^{\circ} 17^{\circ} 11^\prime \[1em
5^{\circ} 11^{\circ} 54^\prime & | 6^{\circ} 9^{\circ} 57^\prime & | 3^{\circ} 9^{\circ} 45^\prime & | 2^{\circ} 3^{\circ} 51^\prime & | 1^{\circ} 12^{\circ} 35^\prime & | 18^{\circ} 13^\prime & | 1^{\circ} 6^{\circ} 12^\prime & | 3^{\circ} 22^{\circ} 9^\prime & | 4^{\circ} 15^{\circ} 18^\prime & | 5^{\circ} 27^{\circ} 1^\prime \[1em
1^{\circ} 12^\prime & | 52^\prime & | 47^\prime & | | | | | | | | \[1em
1^{\circ} 34^\prime & | 1^{\circ} 21^\prime & | 1^{\circ} 44^\prime & | 1^{\circ} 52^\prime & | | | | | | | | \[1em
1^{\circ} 35^\prime & | 1^{\circ} 50^\prime & | 1^{\prime} 39^\prime & | | | | | | | | \[1em
87^{a} 23^{b} & | 224^{a} 16^{b} & | 17^{a} 5^b & | 17^{a} 32^{b} & | 4^{a} 12^{b} & | 4^{a} 21^{b} & | 4^{a} 22^{b} & | 11^{a} 31^{b} & | 29^{b} 16^{b} & | 85^{a} 29^{b} \[1em
15^{a} 33^{b} & | 41^{a} 27^{b} & | 48^{a} 48^{b} & | 23^{a} 18^{b} & | 14^{a} 39^{b} & | 19^{a} 16^{b} & | 8^{a} 59^{b} \[1em
87^{a} 23^{b} & | 224^{a} 16^{b} & | 17^{a} 6^b & | 17^{a} 32^{b} & | | | | | | | | \[1em
15^{a} 44^{b} & | 49^{a} 11^{b} & | 9^{a} 8^{b} & | 23^{a} 30^{b} & | 14^{a} 27^{b} & | 1^{a} 51^{b} & | 8^{a} 39^{b} \[1em
3180 & | 7600 & | 7916 & | 4120 & | | | | | | | | \[1em
86000 & | 79000 & | 34000 \[1em
23^{b} 21^{h} & | 23^{b} 56^{b} 4^{a} & | 24^{b} 39^{b} 21^{h} & | | | | | 9^{h} 51^{b} & | 10^{h} 16^{b} \[1em
300.301 & | 15.16 & | | | | | | | | | | \[1em
12.13 & | 10.11 \[1em
\end{align*}
\]

**DIAMETER IN MILES.**

\[
\begin{align*}
10000 & | 79000 & | 34000 \[1em
25^{b} & | 10^{b} 16^{b} \[1em
358 & | 104 & | 190 \[1em
16^{b} & | 5^{b} \[1em
140^{b} & | 18^{b} \[1em
\end{align*}
\]

**MEAN APPARENT DIAMETER.**

\[
\begin{align*}
10000 & | 79000 & | 34000 \[1em
25^{b} & | 10^{b} 16^{b} \[1em
358 & | 104 & | 190 \[1em
16^{b} & | 5^{b} \[1em
140^{b} & | 18^{b} \[1em
\end{align*}
\]
SYSTEM.

The obliquity of the earth's equator to the ecliptic is 23° 28'; its secular diminution 50'; its perigee change in a revolution of the moon's nodes, 9° each way; the annual precession of the equinoxes is 50.25'; the greatest apparent change of place of the stars from the aberration of light, 20° each way.

The mean inclination of the orbit of the moon, \( \delta \), is 5° 9'; the place of the ascending node 15° 50'; the mean distance 54,000 miles; the eccentricity 13,700 miles; the place of the apogee 2° 26° 7'; the moon's place 3° 15° 2°; the diurnal motion of the node 3° 10'; its tropical revolution 18° 21° 35° 2°; its sidereal revolution 18° 22° 7° 13° 17°; the tropical revolution of the apogee 8° 31° 1° 8° 34° 57°; its sidereal revolution 8° 31° 1° 2° 11° 11°; the moon's tropical revolution 27° 7° 45° 5°; her synodical revolution with respect to \( \odot \), 23° 13° 44° 3°; her diameter 2165 miles; her mass 414 of the earth's; her density 1.742; her apparent diameter 39° 22° to 39° 24°; her horizontal parallax 53° 46° to 51° 26°; at the mean distance 51° 2°.

1 Jan. 1801.


A Table of the Chronology of Astronomers.

<table>
<thead>
<tr>
<th>HERMES 1450 B.C.</th>
<th>CHIRON 250</th>
<th>BABYLONIAN OBSERVATIONS 719</th>
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<td>THALES</td>
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<td>MAMOUN</td>
<td>ALBATEGNI</td>
<td>IBNUIS</td>
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<td>1300 B.C.</td>
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</tr>
<tr>
<td>ULUGH BEIGH</td>
<td>COPERNICUS</td>
<td>WILLIAM H</td>
</tr>
</tbody>
</table>

See Young's Philosophy. Ferguson's Astronomy, by Brewster, vol. ii.
SYSTEM.

Systems of Mineralogy, see Mineralogy, under which article the most eminent systematic writers on mineralogy are enumerated from Agricol to Werner and Hally; and some account is given of the principles of classification on which the different systems are founded. Notwithstanding the labour and talents which have been employed to frame systems of mineralogy conformable to natural and fixed principles of arrangement, it must be confessed that much remains which is arbitrary and uncertain in them all. Mineralogists are not yet agreed as to the principles on which a mineralogical system should be framed, whether on the external character, or the chemical composition of minerals; nor do they even agree in their definition of the essential characters which constitute mineral species.

In the classification of minerals, most mineralogists have considered the chemical composition as too important to be disregarded, wherever it would agree with the other principles of arrangement. Even the Wernerian system professes to be founded on the natural alliances and differences observable among minerals; and these are defined by Werner to depend on the quality, quantity, and mode of combination of the constituent parts; and he considers all minerals as belonging to the same species, that have the same external form and the same constituent parts. Notwithstanding this definition, minerals that differ almost entirely in their chemical composition are arranged together by Werner, and it is only when chemical results agree with the natural alliances (says Mr. Jameston), that he gives them a place in his system. This, it must be admitted, is either a departure from the principles laid down, or a very indefinite application of the terms natural alliance, which was before defined to consist in the quality, quantity, and mode of combination of the constituent parts.

According to the principal French mineralogists, the similarity of composition in minerals, forms the most important alliance which they can possibly have: if two minerals were composed of the same constituent parts, they would be of the same species. The proportion of the constituent parts which constitute the type of the species, is determined by the crystallization; for it is assumed, that the same proportions of constituent parts, give invariably the same primitive forms. On these principles Brongniart defines mineral species to be "an assemblage of individuals having the same composition and the same primitive form." (Introduction à l'Étude des Minéraux.) This principle of classification appears natural and scientific, but unfortunately it is of limited application, as a great number of minerals never occur crystallized; such must, therefore, be left out of the system, or be classified in an arbitrary manner.

In every system of classification, it is proposed either to affix the student to discover the names of minerals from their external characters, or to assign to them their proper place in nature, according to the most essential points of resemblance which they present to the minerals among which they may be classified. The first is called the artificial mode of classification; the latter, the natural. Some mineralogists regard the former as unessential in the science, being little more than a mere mechanical contrivance to recognize the name of known species; according to Berzelius, this can rank no higher compared with a proper system, than as an index to a book.

Dr. Thomson, however, has well observed, that before the chemical analysis of a mineral can lead to any useful inferences, we must be sure that a specimen belongs to the species we suppose, and also that it is unmixed with any other mineral. Now this can only be known by an acquaintance with the external characters, which must therefore serve as the basis of our mineralogical knowledge. Annals of Phil. April, 1815.

In the present state of mineralogical science, it seems highly expedient that there should be two different systems: the one which should arrange minerals according to their appearances and properties by which they may be distinguished; the other, which should be chiefly scientific, in which minerals shall be arranged according to their constituent parts, and the proportions in which they combine; the latter system must be dependent on the progress of chemistry for the state of perfection it may attain.

Both these methods of arrangement have recently been adopted; the first by Mr. Arthur Aikin, in his Manual of Mineralogy; the second by the celebrated Swedish chemist, Berzelius, in a work, intitled "An Attempt to establish a pure Scientific System of Mineralogy, by the Application of the electro-chemical Theory, and the chemical Proprieties." The views which Berzelius has disclosed are novel and highly important, and may ultimately give an entirely new form to the science. He defines mineralogy to be the science which treats of the elementary combinations of unorganic substances, found in or upon the earth, and of the various forms and the different foreign admixtures under which their bodies make their appearance. The knowledge of these combinations themselves, their composition and chemical properties, belongs to the chemistry, but that scientific mineralogy may be considered as a part of chemistry.

Hence, says Berzelius, it is clear that mineralogy can have no other scientific arrangement than a chemical one, and that every other is foreign to mineralogy as a science. The prevailing theory and arrangement of chemistry must therefore be that of mineralogy also. If this has not hitherto been the case, it may be attributed to the recent period in which chemistry has received its greatest improvements, and also to the circumstance, that the framers of systems of mineralogy, have not previously applied themselves with equal zeal and success to chemistry, and consequently have not been enabled to perceive the necessary connection between them. By the influence of electricity on the theory of chemistry, this last science has experienced a greater revolution than it did by the doctrines of Stahl or Lavoisier. The object of Berzelius is to shew that the influence of the electro-chemical theory extends to mineralogy, in the same degree as to the parent science chemistry; and also that the doctrine of definite chemical proportions is equally applicable to the elementary combinations in the mineral kingdom, and will give the same degree of mathematical certainty to the arrangements of a mineralogical system, which it has already given to chemistry. From the electro-chemical theory, we have, says he, been taught to seek in every compound body for ingredients of opposite electro-chemical properties; and we have learned from it, that the combinations cohere with a force, which is in proportion to the degree of opposition in the electro-chemical nature of the ingredients. Hence it follows, that in every compound body there are one or more electro-positive, with one or more electro-negative ingredients. By electro-positive ingredients, he designates those which have inflammable bodies, or fells for bases; and by electro-negative, the oxygen and oxides which go to the negative pole of the Voltaic battery. In other words, every substance called a basis in chemical combination, must have another which acts the part of an acid, though the latter, when uncombined, may not be distinguished by a four taste, or the property of changing vegetable blues to red. The body which, in one case, is electro-negative, may, in another case, be electro-positive, and may be united to a stronger electro-negative, that is, it may be the basis to a stronger acid.
Thus, in the union of two acids, the weaker serves as a basis to the stronger; and every combination of two or more oxides, possesthe nature of a salt, one of the oxides performing the functions of an acid. Were the combination decomposed by the voltaic battery, one oxide would be collected round the negative and the other round the positive pole. Hence in every mineral composed of oxidized bodies, whether an inorganic or organic nature, we must seek for the electro-negative and electro-positive ingredients; and after the nature and qualities of these are found, a critical application of the chemical theory will tell us what the mineral is.

The most usual mineral combinations between oxides contain three oxides, of which two are bases and one acid; and the fourth one of the two oxides in double salt is chemistry. It not infrequently happens that there are even three or four bases for one acid; but we very rarely find a chemical combination of two bases, each united with its different acid.

If with these theoretical ideas we review the productions of the mineral kingdom, what a light do they at once throw on the compounds of various metals united with sulphur, or on the compounds of various earths and metallic oxides: order at once becomes visible in this apparent chaos, and mineralogy affirms the character of a science. We immediately discover a numerous class of minerals, the similarity of which to salts had already been pointed out by chemists, though they were unable to make a more exact application of these resemblances. This class consists of minerals in which flex a part of an acid; it contains an endless variety of single, double, triple, and quadruple salts of different degrees of neutrality, or with excess of acid or base. Thus also oxide of titanium, oxide of tantalum, and several metallic oxides, not considered as acids, occasionally act the part of acids; so that the whole of the extensive range of earthy minerals may be cladded on the same principles as salts.

That flex performs the functions of an acid in the mineral kingdom, was an opinion advanced by Mr. Hume at an early as 1805; and he adduces the neutralizing effects of flex on alkalies in the formation of glasses as an illustration. (See Silicic.) Berzelius regards this new view respecting the combinations of flex with different bases, as the most important step which mineralogy has ever made towards its perfection as a science.

The circumstnaces which have contributed to conceal the existence of chemical proportions in mineralogy are, want of sufficient care in analysis, and the difficulty of meeting with mineral productions perfectly free from admixture with foreign and accidental ingredients. Even the most regular and transparent crystals are seldom entirely free from foreign admixture. The substance of which a solution contains the most, or with which it is saturated, forms the crystal; but this crystal includes parts of the solution between its plates, which not unfrequently change its colour, and render it more or less impure. Hence we find, in the analyses of most crystallized minerals, two, three, or more ingredients, which only amount to per cent., and sometimes less; these we have no reason to believe belong to the composition of the crystallized mineral, but are accidental admixtures; and these foreign substances should be subtracted from the analyses, if the results are expected to agree with the doctrines of chemical proportion.

The form, specific gravity, colour, and transparency of crystals, is also sometimes changed by the deposition of two different compounds in contact with each other; thus the aragonite owes its peculiar form to a particle of siftonite being in contact with carbonate of lime at the time of its crystallization. As the latter kind of admixture makes itself known by changing the crystalline form of a mineral, it may be more easily detected.

In determining the chemical proportions of minerals, and the distribution of the ingredients, Berzelius does not, in the first place, seek for this proportion in the relative quantities of the various elementary constituent parts; but he considers the particles of the different elements as forming binary compounds, which combine with each other in definite quantities. This he illustrates by an analogous mode of determining the distribution and proportions of the substances which compose the well-known salt alum. If, says he, we were to go no farther than to consider this salt as consisting of potash, aluminium, sulphur, hydrogen, and oxygen, we should, in a scientific view, derive but little advantage from such a statement. We come to a nearer nature of the compound, when we consider it as composed of aluminium sulphate, alumina, potash, and water. This was long regarded as the composition of alum; hence it was called a triple salt, as consisting of three principal ingredients. The next step to a more perfect knowledge of alum, was the considering it as consisting of sulhphate of potash, and sulphate of alumina, with water of crystallization. The doctrine of chemical proportions completed our knowledge of this salt, by showing that it consists of one particle of sulphate of potash, three particles of sulphate of alumina, and twenty-four particles of water of crystallization. Chemists have long considered one important class of minerals as composed of peculiar earths, without pointing out their exact combinations, or the definite proportions in the combinations, in the same manner as they have recently viewed the composition of alum. Since the development of the electro-chemical theory, and the discovery of the laws of chemical proportion, it becomes necessary to adopt an exposition of the nature of minerals, conformable to the improvements of chemical science.

Silica is the most abundant substance of which the surface of the globe is composed; and, according to Berzelius, the illustration of that order of minerals in which silica supplies the place of an acid, (being the electro-negative ingredient,) throws the greatest light over the confused mineralogy. The minerals of this order are the most numerous, and he has given to them the name of silicates. Silica, as an acid, possesses the property of forming silicates of many different degrees of saturation. The most general are those in which the flex contains the same quantity of oxygen with the base. The name silicates. When the flex contains three times the oxygen of the base, they are called trisilicates. When twice the oxygen, bisilicates. But when the base contains more oxygen than the flex, they are called fusilicates, and are designated by the terms bis, tri, &c., to announce that the base possesses twice or three times the oxygen of the flex. Of these modes of combination he has given several examples, from which we select a few as illustrative of his theory. It may be proper first to state that he calculates the oxygen in the following earths and alkalies as under:

<table>
<thead>
<tr>
<th></th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alumina</td>
<td>49.64</td>
</tr>
<tr>
<td>Magnesia</td>
<td>46.7</td>
</tr>
<tr>
<td>Lute</td>
<td>38</td>
</tr>
<tr>
<td>Barytes</td>
<td>25.66</td>
</tr>
<tr>
<td>Soda</td>
<td>17</td>
</tr>
<tr>
<td>Potash</td>
<td>17</td>
</tr>
</tbody>
</table>

In 100 parts of flex or silica
SYSTEM.

In the examples which he has given, we are not to expect the analysis to coincide exactly with the calculation, particularly in compound minerals; but must be content, he says, with such results, if the difference from the calculation does not exceed the usual errors in other analyses.

Example.—Calcareous Trifliciate, a mineral from Adefors, analysed by Hafinger.

Silica 57.77 holding 28.75 3 58.62 Sulphur. Fluoric radicle.
Lime 35.50 oxygen 9.80 1 34.58 Nitricium, or the radicle of azote. Boron.
Alumina 1.83 Oxyd of iron 1.00 3 4.35 Muriatic radicle. Carbon.
In this example, we may observe, that, according both to the analysis and the calculation, the silicium, which may be considered as the acid, contains three times more oxygen than the lime, which is considered as the base.

Calcareous Bifliciate, or Table Spar, analysed by Klaproth.

Silica 50 holding 34.83 6 50.00 Arsenic. Lead.
Lime 42 oxygen 12.6 3 44.33 Chromium. Tin.
Water 5 holding 4.4 1 4.70 Mohylbdenum. Nickel.

Aluminous Silicicate. Semmrite.

Silica 46 holding 22.83 1 46.05 Tungsten. Copper.
Alumina 49 oxygen 23.28 1 48.95 Antimony. Uranium.
Foreign ingredients, lime, 2; oxyd of iron, 1.

The above are examples of simple silicicates; but Berzelius states that silices, like other acids, forms also double silicates; and we most frequently find that the bases which have a tendency to produce double silicates with other acids do the same with silices.

Example of a double silicate. Trifliciate of Potash and Lime; the Ithyophyllalmite of Werner. Apophyllite of Italy. It contains

Silica 52 holding 25.81 18 50.83 Arsenic. Lead.
Lime 24.5 contains 6.71 5 25.4 Chromium. Tin.
Potash 8 oxygen 1.26 1 8.24 Mohylbdenum. Nickel.
Water 15 holding 13.23 10 15.89 Tungsten. Copper.

This mineral is thus a double salt, or silicate of lime and of potash, in which the former contains five times the oxygen of the latter, and the silice three times the oxygen of the bases. It is composed of one particle of trifliciate of potash, and five particles of trifliciate of lime.

Berzelius gives examples of more complex silicates, but the above may serve to shew the mode which he adopts in the distribution of the component parts of silicious minerals, and in estimating their proportions; and we may make a similar application of the same principles to other minerals.

The mineralogical arrangement propounded by Berzelius, is founded on the order of the electro-chemical properties of bodies, beginning with the most electro-negative oxygen, and terminating with the most electro-positive potassum, and placing every compound body according to its most electro-positive ingredients. But he observes, that in the present state of science, we must be content with an approximate arrangement. He divides single bodies into three classes: 1. Oxygen; 2. Simple non-metallic inflammable bodies, which he calls metalloids; 3. Metals. He arranges them in the order in which they follow one another, from the most electro-negative to the most electro-positive, in every class. This order is nearly as follows:

1. Oxygen.
2. Metalloids.

Every one of these bodies can constitute a mineralogical family, which will consist of that single body, and all its combinations with bodies that are electro-negative towards it, that is, all those which (with some few exceptions) precede it in the above series. Thus there may be as many families as there are simple substances. The families are divided into orders, according to the different electro-negative bodies with which the most electro-negative is combined. The characters, and the formula propounded by Berzelius to express in a concise manner the different mineral combinations, is it unnecessary to state, as they will probably undergo a considerable change when the system shall have attained a more complete form. It must be confessed, that the obstacles which oppose themselves to the formation of a complete mineralogical system, on the principles propounded by Berzelius, appear to be great, particularly with respect to many of the minerals that never occur crystallized, as it seems that we have no means of determining the proper constituents ingredients from the mechanical admixtures which they may contain. If, indeed, chemistry should attain that high degree of perfection which will enable us to discover the limits of all the possible combinations of the elementary parts of minerals, we may then substract from our analyses those parts which do not fall within their limits, as being in mechanical admixtures, in the same manner as the chemist is now enabled to determine, from the definitions of definite proportion alone, the quantity of uncombined acid or alkali that exists in a saline solution, when either of the ingredients is in excess.

If one class of bodies consists of salts, in which the same performs the functions of an acid, combining with them in definite proportions, the discovery of these proportions in the different combinations, is the most important step to the advancement of mineralogy as a science.
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It remains that we notice the mineral system of Mr. Aikin, the principal object of which is to enable the student to ascertain the names of known minerals from certain properties joined with their external characters. The difficulty of attaining this knowledge from the systems hitherto published, is universally acknowledged, although the number of minerals, considered as species, does not exceed four hundred. Mr. Aikin arranges minerals into four classes, from their chemical characters. The orders are distinguished by properties which are supposed to be the most characteristic, or by which they may be most easily known.

CLASS I.—Non-metallic combustible minerals.
Order 1.—Combustible with flame; 2, without flame.
CLASS II.—Native metals and metaliferous minerals.
Order 1.—Volatile wholly or in part by the blowpipe, into a vapour which condenses in a pulverulent form on a piece of charcoal held over it.
Order 2.—Fixed, not volatile, except at a white heat.

The minerals of these two orders are arranged as they are more or less volatile, have a metallic or non-metallic lustre, are magnetic or non-magnetic, or are reducible to the metallic state.

CLASS III.—Earthy minerals.
Order 1.—Soluble wholly, or in a considerable portion, in dilute muriatic acid.
Order 2.—Fusible before the blowpipe.
Order 3.—Involatile before the blowpipe.

The minerals of orders 1 and 2 are arranged according to their degrees of hardness.

CLASS IV.—Saline minerals.
Order 1.—When dissolved in water afford a precipitate with carbonated alkali.
Order 2.—Do not afford a precipitate with carbonated alkali.

The different orders and subdivisions in each class are arranged without any regard to the constituent parts. But a mineralogical description of each species is also given, with an account of the component parts of those minerals of which the analysis is known.

SYSTEM OF GEOLOGY. The structure of the globe we inhabit, and the revolutions it has undergone in former ages, may justly rank among the most interesting objects of inquiry that can engage the attention of mankind in an advanced state of the physical sciences. It is scarcely half a century since geology began to be cultivated; and the various theories of the earth which appeared before that time, can only be regarded as amusing speculations, unsupported by existing phenomena. The systems of Woodward, Burnet, and Buffon, are given under the article EARTH.

Since the position and nature of the rocks and strata that compose the crust of the globe have been investigated in various parts of its surface, other theories and systems have been formed, which profess to be founded on established facts, or on legitimate inferences from them. When striking and complicated phenomena are first presented to our observation, we seek with avidity for some general principles which shall connect and elucidate the whole; and if we trace a few links of connection, which appear dependent on one and the same cause, we are too apt to consider the discovery as already completed, and to make our future observations subservient to the establishment of a system. This tendency to form premature generalizations, is the "sin which most easily befits" the first cultivators of every branch of natural science, and we are not to expect that geologists could entirely escape its influence. Fortunately, however, two systems, founded on different principles, were advanced nearly at the same time, with equal claims on public attention; the first of each not infrequently disagreed in their inferences from the same facts, and also in their explication of the facts themselves. Hence others were induced to examine nature more accurately, and new and more important facts were disclosed; thus the clouds which settled on the cradle of geology, have been blown aside by the breezes of conflicting opinions.

Every system of geology, if complete, should comprise the structure and composition of the earth's surface, the changes which it has undergone, and the changes now taking place by external or subterranean agents: it should trace, in existing phenomena, the causes by which former changes were effected, and endeavour to discover the extent of their operations, and to distinguish partial revolutions from those which have affected the whole globe.

The internal structure of the globe is concealed from human observation; the materials ejected from volcanoes come in all probability from vast depths, and are composed of similar elements to those which form its surface; but in what state those elements exist in the central recelles of the earth, or in what manner they are arranged, will perhaps for ever remain unknown.

"A great essaying the feeble efforts of his slender probation against the hide of the elephant, and attempting thereby to investigate the internal formation of that large animal, is (says Dr. Watson) no unpainted representation of man attempting to explore the internal formation of the little holes into its surface." (Chemical Essays, vol. 1.) From the fractures and dislocations of the strata, we are however enabled to make ourselves acquainted with the structure of the globe to far greater depths, than it is possible to reach in mining operations; and the subterraneous agents, of the globe, come in all probability from beds far below any which rife to the surface. Still it must be confessed that our knowledge of the inner part of our planet is nearly confined to one fact, namely, that it possesses greater density than the earth and strata, on which the surface is principally composed.

The mean density of the whole globe, as ascertained by the observations of Dr. Maclay and Mr. Cavendish confirm those of Playfair. It is at least five times that of water. The experiments of Dr. Cavendish confirm the above estimate. Hence, if the globe could be weighed in a scale, it would require five globes of water, or two and a half of common limestone, to balance it. If the diameter of the earth be 7920 miles, and it were composed of an outer spherical crust of common stone 1300 miles in thickness, it would require that the inner space, 5610 miles in diameter, should be filled with a substance equal in density to melted silver, that the whole globe might have the present mean density of the earth. If we admit the observations and experiments of Dr. Maclay and Mr. Cavendish to have established the density of the earth, as above stated, it follows that the inner part is not a hollow space, neither is it filled with air, water, or ice, as some philosophers have conjectured; and if it contain large caverns, the remaining solid parts must have greater specific gravity than many of the known metals.

The structure of the external part of our planet is exploded to observation in the interseuctions made through mountains by torrents and rivers, by the action of the sea upon the coasts, by fractures of the strata, and by the irregular
gular rise to the surface in an inclined position. It is probable that the total thickens of the crust of the globe thus exposed to our view in different districts may not be less than four or five miles. See Rock and Strata.

From the phenomena presented by the various rocks as they rise to the surface, geologists have drawn very different conclusions with respect to their formation; and two sects of geologists have been formed, the one can see in these phenomena only the agency of water, and the effects of chemical precipitations or mechanical deposits from an aqueous fluid; hence they have been called Neptunians. The celebrated professor M. Werner of Freiberg has given to these opinions a regular systematic form; hence the Neptunian theory is more frequently called the Wernerian system of geology. It has been explained at some length by the disciples of Werner, and has been warmly and ably supported by many eminent geologists. Other geologists consider subterranean heat as one of the great agents in the formation or consolidation of rocks, hence they have been called Volcanists and Plutonists, and their theory has been called the Plutonian system.

The late Dr. James Hutton, of Edinburgh, gave to this theory certain modifications, and a more comprehensive range; and it is usually designated the Huttonian system. The leading positions in which the Wernerian and Huttonian systems agree, are, that the present continents have been covered by the ocean; and that the materials of which the upper rocks and strata are composed, were deposited from an aqueous fluid. From these points of agreement they widely diverge in their explanation of the causes by which the continents were laid dry, the mountains elevated, and the materials converted into stone.

Neptunian or Wernerian System.—That part of the Wernerian system which comprises the classification of rocks, has been given under the article GEOLOGY. The speculative part of this system comprises the mode of their formation, and the original condition of the globe. According to Werner, the primeval ocean holding in solution the materials of rocks and strata, flood high over the whole earth in a calm and undisturbed state. The elementary materials began to crystallize, and fall down in this quiet state of the waters, and formed the granitic pavement of the globe. As the crystallization proceeded, elevated peaks and ridges shot up into the water, and occasioned the original inequalities of the surface. Successive deposits covered the sides and summits of the lower crystalline masses, forming the rocks denominated primary. After or during this process, the waters began to retire, and the summits of the loftiest mountains emerged from the abyss. "The waters at this period became agitated; yet this at first only prevented the perfection of the crystallization. As the water diminished in height, its motions were increased, the agitation extended down to the surface of the earth, and the crystalline florets were destroyed; thus the first mechanical productions were formed. The water still continuing to diminish, the dry land began to appear, of course the mechanical action of the water would be much increased, as also the formation of mechanical productions." The lower rocks are entirely chemical, but the crystallization becomes more and more imperfect in the newer formations, and the chemical deposits increase, the newest formations being principally mechanical productions. The Wernerian geologists conceive, that they can trace this progressive diminution of the waters of the globe, and the change which took place in the nature of the deposits. When we view the various depositions of the earliest discoverable periods to the newest, we find, says Mr. Jameson, such differences in them, as shew that the contents of the water of the globe must have changed by degrees, and that all its depositions form a beautiful connected series. The oldest rocks, which are pure chemical precipitates, are composed principally of silicious, argillaceous, and magnesian earths. These rocks, as granite, gneiss, and mica-flake, contain metals that are of contemporaneous formation with them, and that scarcely occur in new periods; these are tin, molybdena, and tungsten.

The state of the water of the globe, however, alters gradually and remarkably, as we approach the newer periods, by the abundant appearance of lime-flour, and the occurrence of coal and salt, and the disappearance of the old and the appearance of new series of petrifactions. Before the general succession discoverable in the productions of different periods, we have influences of the repetition of certain periods in considerable intervals, and in formations of different cast. In a series of this kind, all the members have general characters of agreement, and the individual members bear characters expressive not only of the period of their formation, but also of the circumstances under which they were formed. Such a series is denominated by Werner a principal formation, suite, or series of formations.

Mr. Jameson describes the lime-flour formation, as it occurs in the primary period of the crust of the earth. Amongst the first rocks denominated by Werner, are the flinty rocks, to illustrate a principal formation suite. The first member of the lime-flour suite is the white granular lime-flour, which occurs in gneiss, mica-flake, and clay-flake. The granular distinct concretions are large; but in the newest clay-flake they become more minute, and it even approaches to compact. The transition rocks contain the second member of this series, the variegated lime-flour, which has less translucence than the preceding, but more than the following members of the series. This lime-flour shows the first signs of petrifactions. The following rocks, the flints (or flint felsas), contain the third member of the series, the pure flinty lime-flour, which is scarcely translucent on the edges, and is full of petrifactions. It has some resemblance to the lime-flour of the transition period, but only a very remote one to the primitive. Chalk is the newest formation of the period: it connects the foregoing members, which have been deposited from the ocean, with the calc-tuff, the lowest link of these formations. (See TUFFA and TUFF.) We have thus a complete series from the earlist to the last period, in which we notice the gradual appearance of the crystalline, and increase of the earth's effects, corresponding with the relative age of the different members of the series, and the state of the solvant, from which they were precipitated; and all serving as proofs of the immensely gradual, but gradual, alteration of the state of the universal water.

As the waters, according to this system, covered the whole globe during the formation of the primitive and oldest transition rocks, neither land-places nor land-animals could exist; and the first traces of organic existence which appear in the transition rocks, are the remains of marine plants and animals. (See Marine Rocks.) The first relics of land-places or animals occur in the newer transition rocks, which were formed after a portion of the land was uncovered, and capable of supporting terrestrial vegetation. From this period to the newest or alluvial, the quantity and variety of vegetable remains increase, and this is further confirmed by a corresponding increase of coal. As the water diminished, it appears to have become more fitted for the support of animals and vegetables; for we find them increasing in number, variety, and perfection, and approaching more to the nature found in the present state. The same gradual increase of organic beings appears to have taken place on dry land.
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As the water, according to this theory, covered the whole globe, when it first began to precipitate its contents, they were spread all over its surface, and constituted masses of stone encircling each other, like the coats of an onion. The principal rock formations are, therefore, called universal formations; besides which, there are some local formations of limited extent. The principal coal formations, according to Werner, are of this kind, and are called independent formations.

We have now to notice a remarkable feature in the Wernerian system. There are certain rocks which occur, covering other rocks and strata, without any conformity with the position of the lower beds. These rocks are principally trap, porphyry, and fiesite. (See Trap, Porphyry, and Sienite.) The nature and position of these rocks bear a similarity to that of many volcanic rocks. They are denominated in the Wernerian system varying formations. Porphyry and fiesite, according to this system, are of a far earlier date than basalt. To explain the formation of these rocks, the Wernerian geologists tell us, that after the water, which covered the whole globe, had retired to its present level, it rose again at two different periods, and covered some of the highest mountains. In the first period, it deposited the rocks of porphyry and fiesite; in the second period, it deposited the rocks of basalt, or what they call the newes flata trap. At the latter period, the water rose to the height of 11,000 feet, at least above the level of the sea.

The water of the second rising was in a very turbid and agitated state: hence its first depositions were mechanical, or composed of gravel, sand, and mud; but as it became calm, the depositions were principally chemical precipitates, forming basaltic rocks. After these labours of the ocean were completed, it retired with considerable rapidity to its former level.

According to the system of Werner, metallic and mineral veins were originally fissures in rocks, which have been subsequently filled by water, holding the contents in solution. See Veins.

The principal objections to the system of Werner are, first, that by far the greater part of the substances of which rocks are composed are insoluble in water, or require such a large proportion of it for their solution, that the capacity of the whole globe, were it a hollow sphere, would be too small to contain a sufficient quantity of the aqueous menstrum.

Nor can this objection be removed, by supposing the aqueous fluid to percolate far greater solvent powers than the ocean; for the marine organic remains found in different strata prove, that the water must have been similar in its nature to that of our present seas and lakes.

Secondly. "What has become of the immense volume of water, that once covered and filled so high over the whole earth?" To this objection, which is stated in the words of Mr. Janssen, he replies, "Although we cannot give a satisfactory answer to this question, it is evident that the theory of the diminution of the waters remains equally probable. We may be fully convinced of its trueness, and see it, although one may not be able to explain it.? To know from observation that a great phenomenon took place, is a very different thing from explaining how it happened."

Thirdly. The succession of rocks in different countries very rarely agrees with that of the universal formations, described by the disciples of Werner; nor can we trace such a regular gradation in their crystalline structure as the theory assumes: whereas if the waters, which deposited the primary rocks, covered the globe in a calm and quiescent state, the succession of deposits would be similar in the remotest districts. To this it may be replied, that though all the different orders of primary rocks, enumerated by Werner as universal formations, rarely succeed each other in any one situation, yet, wherever two or more occur together, their arrangement is generally conformable to his system; and this is as much as we can reasonably expect. Other geologists remove the objection, by modifying the system itself, assuming that the primary rocks were deposited at the same time, and are to be considered as contemporaneous formations.

Fourthly. The formation of basaltic rocks on the summits of lofty mountains cannot be satisfactorily explained by a general inundation. Indeed the cause assigned is not only at variance with existing appearances, but is contrary to the established laws of nature. "It is scarcely possible for the human mind to invent a system more repugnant to existing facts. Were basaltic rocks deposited from a solution that covered the whole globe, after the formation of the secondary strata, every part of the dry land, and every valley, must have been inundated or filled with basalt. It would be the prevailing rock of every district. On the contrary, basalt exists only in detached masses of limited extent; nor do fragments of basalt occur in any quantity, which can warrant the belief that it was ever formed over the whole globe. (Bakewell's Introduction to Geology.) Many of the basaltic rocks, to which the Wernerians attributed an aqueous origin, are now generally admitted to be volcanic; and the similarity of their composition with lava has been recently more fully established by the researches of D'Aubriéon. See Volcanic Products and Trap.

The objections made to many parts of the system of Werner, as originally announced by his followers, it would be difficult, if not impossible, to remove; but the system is susceptible of modifications, which may make it more conformable to the present state of our information; and some of its most strenuous supporters begin to perceive the necessity of adopting such modifications, in their exposition of the theory. Whatever may be the ultimate fate of the Wernerian system, it cannot be denied that its publication was of material service to the progress of geological inquiry. The striking similarity which it pointed out between many rock formations, in distant countries, if it has not proved their identity, nor the univcrsality of such formations, has at least established an important fact, that proceeds of a nearly familiar kind succeeded each other in the same order, in distant parts of the globe. To Mr. Werner we are also indebted for a knowledge of the mineral repositories peculiar to certain rocks. We have thus obtained some fixed principles to guide us in our geological investigations.

M. De Luc assumes that the strata were formed by chemical precipitations, but differs from Werner in his explanation of the caucuses that have laid dry our present continents. According to this geologist, the relative level of the continents and the sea was produced by the subidence of pre-existing continents, over which the sea immediately flowed. The broken state of the strata composing our continents was not an effect of the revolution which gave them birth; it resulted from successive catastrophes undergone by the strata, during the period of their formation at the bottom of the sea; and these catastrophes were occasioned by caverns formed beneath them. The cavities of lakes, the valleys among mountains and hills, the abrupt and shattered faces which these eminences present towards the plains, existed on our continents at the very period of their birth; being the effects of those catastrophes that fractured the strata of which these continents are composed. A succession
fion of such catastrophes was continued, till the continents were abandoned by the sea. Since that epoch, all the operations to which they have been subjected by atmospheric causes, gravitation, and defraying waters, have only tended to efface the original characters, by reducing abrupt precipices into gradual slopes, by softening down the asperities of hills, by raising, instead of excavating, the beds of valleys and by filling up the cavities of lakes. The beds of gravel and blocks of flint, found scattered in such large quantities on the surface of the earth, nay even the blocks observed in the beds of rivers, were not deposited there by running waters, but are among the original characters of our continents. The gravel composed of flints is derived from decomposed chalk flints, at some period subsequent to their formation; yet whilst they were still covered by the sea, the flints only remaining as we now find them.

The gravel formed by the attrition of fragments of the flint, as well as the blocks of flint, were projected from the interior of the earth by the expendable fluids, during the subidence of the flint, and were subsequently spread over the bottom of the sea by the agitation of the water. The naked and precipitous cliffs which border some of the coasts, are not, says M. de Luc, to be ascribed to the action of the sea; they are original characters, resulting from dissections of the flint, at the period of the vast subidence which produced the new basin of the sea; the action of which directly tends to obliterate the original characters, by forming fronds and at the feet of cliffs. Thence it is, when sufficiently raised and extended, permit the steep faces to be gradually reduced into slopes.

The quantity of loose materials brought down by rivers was at first considerable, and mixed with large fragments of rock, on account of the broken surface over which the waters descended to the coast. These transplantsations of loose materials diminished in proportion to the progress of vegetation on the surface, when its asperities were softened, and the rivers became restricted within fixed beds. Since the birth of our continents, the level of the sea has not changed. Lastly, all the operations which had a tendency to alter the original form of our continents commenced at the epoch of their birth. We still behold the causes which produced those changes, for they are still operative, and by studying them with care, we may ascertain all that they have effected in any particular place. We may even trace, says M. de Luc, what each cause has effected within known periods of time, a circumstance which supplies us with chronometers of different kinds, all independent of each other, and these chronometers agree in testifying that the age of our continents cannot exceed 4000 years. According to M. de Luc, the formation of caverns was produced by the infiltration of the primordial liquid (from which the flint was precipitated) into the interior parts of the globe; hence also refuted a cause of successive changes in the nature of the precipitates. The reader may consult the numerous travels and publications of this philosopher for a more full exposition of his system. The existence of immense caverns in the earth is assumed to explain the fractures and depressions of its surface, but is at variance with the ascertained mean density of the earth. It must be acknowledged that the theory of M. de Luc has some advantages over that of Werner, as it affirms a cause for the retiring of the water, and the elevation and depression of the flint; whereas, in the system of Werner, the present inclination of the flint is supposed to be coeval with their first formation, a supposition which seems contradicted by general appearances in almost every part of the globe. According to M. de Luc, the changes now taking place on the earth's surface will cease when all its projecting points and asperities are smoothed down or covered with vegetation; and the processes now taking place have a regular and progressive tendency to bring the solid parts of our planet into a quiescent and permanent state.

Phlyctenian or Huttonian System.—The Huttonian system of geology does not carry us back to the original formation of the globe. Dr. Hutton, in his author, supposes that the present dry land was at a former period the bed of the sea. According to this theory, the flint was not precipitated from a chemical solution, on the contrary, they exhibit proofs that the substances of which they are composed existed as the elements of other bodies that must have been destroyed before the formation of the present continents. Although the ruins of a former world are not to be found in every piece of rock, they are generally diffused, as is leave no doubt (says Dr. Hutton) that all the flint was formed from the materials of continents that previously existed, and that these materials have been carried into the sea by the same cause which are now wearing down our present continents. Every island or continent, he observes, has its extremities, the mountain-summit, and the sea-shore. On one extremity there is no increase, but a constant decay. The rocks being split into fragments by the agency of heat, frost, and moisture, these fragments are removed by rains and tides in gradual succession, from the highest stations to the lowest, and are further broken in their descent. Having reached the shore, they are dashed by the returning tides upon the coast, and serve as the instruments of its destruction, using the violence of the waves in excavating and breaking down the solid ground. Thus the present dry land is constantly diminishing, and thus the materials of former continents were carried to the ocean, and spread over its bed, either in the state of gravel, sand, mud, or impalpable cement, covering the remains of marine animals by successive deposition. According to this theory, the agent by which these materials were formed into solid flint is of terraeana fire, which is supposed to exist in the central recesses of the globe, and to have periods of increased activity, by which certain parts of its surface are heated and confounded together. The same internal fire acting with great intensity on the lower parts of the globe, the materials which form mountains of granite were then in a state of perfect igneous fluidity, and the fluid was continuing to expand, raised the flint by which it was covered from the watery abyss, and former continents were inundated or sunk down.

The new continents were immediately exposed to the last disintegrating causes by which former continents had been wrought; valleys were excavated in the softer beds by rains and water-courses, and the ocean commenced its attacks upon the coast. Thus materials are preparing for the formation of the flint of future continents to be raised from the sea by the same cause. "Here then," says professor Playfair, "we have a series of great natural revolutions in the condition of the earth's surface, of which we neither see the beginning nor the end; and this circumstance accords well with what is known concerning other parts of the economy of the world. In the continuation of different species of animals and vegetables that inhabit the earth, we discern neither a beginning nor an end; and in the planetary motions, where geometry has carried the eye so far, both into the future and the past, we discover no mark, either of the commencement or the termination of the present order. It is unreasonable indeed to suppose that such marks should exist anywhere. The Author of nature has not given laws to the material, which, like the constitutions of men, carry in themselves the elements of their own destruction; he has not permitted in
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His works any symptom of infancy or old age, or any sign by which we may estimate either their future or past duration. He may put an end, as he no doubt gave a beginning, to the present system, at some determinate period of time, but we may rest assured that this great catastrophe will not be brought about by the laws now existing, and that it is not indicated by anything which we perceive.

According to the Huttonian theory, granite, which is considered by Werner as the oldest rock formation, is of more recent origin than the strata incumbent on it. It is regarded by Dr. Hutton as a subsidence which has been erupted from great depths in a state of igneous fusion, burrowing through the strata in some parts, and upheaving the whole from their subterranean situation. The original fluidity of granite is, he conceives, evinced by its crystalline structure, and also, that the fluidity was not that of the elements taken separately, but of the whole mass. It is the particular kind of granite called graphic (from the supposed resemblance of the quartz to the form of Hebrew letters), the quartz is impregnated by the rhomboidal crystals of felspar, and the felspar is highly compact and consolidated; hence this granite is not a congeries of parts, separately formed and agglutinated together. The perfect consolidation of granite may be added as a further proof of its having been rendered fluid by heat; had it crystallized from an aqueous solution, we should have found intercalations between the crystals. The view that granite has frequently been formed by incumbent schists, offers further proof that the granite must have been in a fluid state: the whole mass was also fluid at the same time. This, according to Dr. Hutton, could only have been effected by subterranean heat, which also impelled the melted matter against the incumbent beds with such force, as to raise them from their place, and give them that highly inclined position, in which they are still supported by the granite, after its fluidity ceased. See VEIN.

Thus a conclusion, rendered probable by the crystallization of granite, is established beyond all contradiction by the phenomena of granite veins. With the granite we shall, therefore, says Professor Playfair, ‘confide the proof of the igneous origin of all mineral substances as completed. Thence, whether stratified or unstratified, owe their consolidation to the same cause, though acting with different degrees of energy. The stratified have been in general only softened, whereas the unstratified have been reduced to a state of perfect fusion. In this general conclusion we discover two parts, which in their degree of certainty differ perhaps somewhat from one another. The first of these, and that which stands in the highest point of evidence, consists of two propositions, namely, that the fluidity which preceded the consolidation was simple, that is, did not arise from the combination of these substances with any solvent; and next, that after consolidation, these bodies have been raised up by an expansive power, acting from below, and have by that means been brought into their present position. These two propositions seem (says Professor Playfair) to be supported by all the evidence that is necessary to constitute the most perfect demonstration.’

The other proposition is that the sole cause of the fluidity and subsequent elevation of these mineral bodies, is, he admits, a matter of theory. ‘The cause, however, which is assigned is sufficient for the effect, and the same is not true with respect to any other known cause. This theory accounts, with singular simplicity and precision, for a system of facts, so various and complex as those which the natural history of our globe presents. Nor is the principle of subterranean heat assumed without evidence; on the contrary, it is proved by the phenomena of hot springs, volcanoes, and earthquakes; these leave no doubt of the existence of heat, and of a moving expansive power within the earth.’

It has been objected to the igneous origin of granite, that if it had been in a state of fusion when erupted from below, why did it not diffuse itself in torrents on the surface. To this objection Professor Playfair, its eloquent advocate, replies, ‘The theory of Dr. Hutton would not defer a moment’s consideration, if it were so inartificially constructed as to suppose that granite was originally fluid, and yet to point out no means of hindering this fluid from diffusing itself over the strata, and settling in an horizontal plane. The truth is, that his theory, at the same time that it conceives this fomite to have been in fusion, supposes it to have been ejected in that state among the strata already consolidated; to have heaved them up, and to have been formed in the concavity so produced as in a mould. The covering of strata thus raised up, may have been burst asunder at the summit, where the curvature and elevation were the greatest, but the melted mass underneath may have already acquired solidity, or may have been sustained by the beds of schist incumbent on its sides. This schist, forming the exterior crust, was immediately acted upon by the cauæ of want and decomposition, which have long since stripped the granite of a great part of its covering, and are now exercising their power on the central mass. We are led to think that even Mont Blanc, as well as other unstratified mountains, was once covered with fchitis, will appear to have in it nothing incongruous, when we consider the height to which the fchitis hill rises on its sides, or in the adjacent mountains; and from the appearance of want and degradation which these mountains exhibit, it is certain that the chitis mass must have reached much higher than it does at present.’

Mineral and metallic veins, that interm check rocks and strata, are supposed by Dr. Hutton to have been cracks, or fissures, originally formed by subterranean heat, and that they were filled with their contents by melted matter ejected from beneath. In some instances, the matter was sublimed in the form of vapour, which condened and crystallized on the sides of metallic veins.

The mineral veins are generally filled either with granite, porphyr, green-stone, or basalt. They are of vast extent, often traversing the whole country. As the materials which fill these large veins are frequently harder than the rocks which the veins intersect, they remain undecomposed after the surrounding rocks have perished, rising like a wall above the surface; hence in the northern parts of our island they are called dykes, the term being synonymous with a wall.

These dykes produce great changes in the position of the strata which they intersect, and are considered by Dr. Hutton as affording strong proofs of the former. The basaltic dykes bear more immediately the marks of their igneous origin, as the composition and appearance of this fomite have a great resemblance to many volcanic lavas. The changes produced on the rocks which they pass through are such as might result from contact with substances in a state of fusion. Basaltic rocks exist in countries far remote from any active volcanoes; they prove, therefore, that subterranean heat has been an important agent in the formation of our present continents.

The transition which may frequently be traced from granite to flænite, green-stone, and basalt, leads to the conclusion that they had all the same origin.

As the difference between stratified and unstratified rocks consists in the latter having been perfectly fused, and the former
former only softened by subterranean heat, so farther the strata were removed from the granite, they were less acted upon by central heat, and were left in a more earthly state; but where the materials of strata were easily fusible, such strata became more crystalline than other strata in a similar situation, but composed of refractory materials. While the strata were in a soft state, they were sometimes subjected to two forces, the one arising from the pressure of superincumbent rocks, the other from the partial depression or elevation of the earth's surface in their vicinity, which occasioned a lateral pressure, and these two forces, acting at the same time in a direction nearly at right angles to each other, produced those remarkable contortions and convolutions of the strata, which may frequently be observed in schistose rocks adjoining the granite, as represented in Plate III. Geology, fig. 6.

The theory of Dr. Hutton is distinguished from that of former Plutonists, by the aid which it derives from the introduction of compression, as a powerful agent in the formation of our present strata.

It had been objected to the system, that the present state of mineral bodies is very different from that in which we should have seen them, had they been subjected to intense heat. Lime-flint in particular is rendered caustic by heat, the carbonic acid being driven off, whereby it is converted into quick-lime. Now if the lime-flint rocks had been subjected to a great heat, they would have been left in a caustic state, like burned lime. To this Dr. Hutton replied, the circumstances under which these rocks were heated, were very different from those in which lime-flint is calcined by common fire. Under the pressure of the ocean, at a great depth, the carbonic acid would be prevented from escaping, and being confined, it would contribute to render the lime fusible; hence in cooling, it acquired its crystalline texture.

This conjecture of Dr. Hutton's could be considered as little better than an hypothesis assumed to remove a difficulty from his system, until Sir James Hall proved its accordance with nature, by a series of ingenious and most decisive experiments. He confined powdered chalk in a gun-barrel, so closely as to prevent the extraction of the carbonic acid, and then subjected it to the heat of a furnace, by which it was fused and consolidated, and converted into a substance resembling crystalline marble.

"From these experiments it appears, that a preasure of 32 atmospheres, or 1700 feet of sea, is capable of forming a lime-flint in a proper heat; that under 80 atmospheres, answering nearly to 3000 feet, or about half a mile, a complete marble may be formed; and lastly, that with a pressure of 173 atmospheres, or 5700 feet of sea, or little more than one mile, the carbonate of lime is made to undergo complete fusion, and to act powerfully on other earths." Translations of the Royal Society of Edinburgh, vol. vi. p. 149.

The igneous system has received additional support from other interesting experiments of Sir James Hall, proving that compression, and the different circumstances under which mineral bodies become consolidated after fusion, greatly modify their state, and sometimes entirely change their external appearance. Thus basalt and lava, when melted and cooled rapidly, are converted into a black glass; but if suffered to cool slowly, they acquire a texture resembling that of the original flint. See Rowley-Raige, and Trap-Rocks.

In what manner the subterranean heat is generated, or by what causes it is called into a more active state at particular periods, the supporters of this theory do not think it necessary to inquire; it is sufficient that the effects are every where discernible; nor is it more difficult to conceive that heat should be confined in the interior of planets, than that light should be constantly emitted from the surface of the sun. The extent to which volcanic fires are operative, prove that the source of heat is situated at great depth. The bed of the ocean is heated at a considerable distance from Sicily during some of the eruptions of Etna, as is proved by soundings taken at the time. The sea is constantly in a boiling state near one part of the island of Volcano, and the black sand on the shore is so hot that it cannot be held in the hand; indeed, there can be little doubt that all the volcanoes in the Lipari islands have some communication with Etna and Vefius. The connection which more distant volcanic fires appear to have with each other, will be noticed under the article Volcano. The number of submarine volcanoes which have been observed since the ocean has been more traversed, proves the existence of submarine fire under almost every degree of latitude; and the numerous volcanoes of the Andes are of sufficient magnitude and power to produce considerable changes on the surface of the globe, and overwhelm whole provinces in a single night. The craters of many extinct volcanoes exceed in fact those which are at present in a state of activity; and according to Humboldt, the most ancient volcanic lavas bear the least resemblance to primary rocks. These ancient lavas were probably erupted under the preasure of the ocean, at the period when all the present continents were covered with water.

The number and extent of ancient and existing volcanos may lead us to infer that they have an important office to perform in the economy of nature. "A volcano," says Dr. Hutton, "is not made to frighten superstitious people into fits of piety and devotion, nor to overwhelm devoted cities with destruction. A volcano should be considered as a spireacle to the subterranean furnace, in order to prevent the unnecessary elevation of land and the fatal effects of earthquakes; and we may rest assured that they in general wisely answer the end for which they were designed, without being in themselves an end for which nature had exerted such amazing power and contrivance."

We should not do justice to the theory of Dr. Hutton, in contemplating the possible effects of subterranean heat; we did not bear in mind the important difference between combustion and ignition. Most bodies exposed to heat in contact with the atmosphere undergo a chemical change, their more volatile parts are driven off, and the inflammable parts combine with oxygen; but under preasure, and confined from all access to air, the same bodies might remain for ages without undergoing any change but that of simple fusion, even at the highest degree of temperature with which we are acquainted.

According to the theory of Dr. Hutton, the different continents that now exist, may have been raised at different periods. Nor are circumstances wanting to confirm the opinion, that the American continents are of more recent formation than those of Asia or Africa; and traditions, according to Plato, seem to have preserved some memory of events that have sunk down in the Atlantic oceans. (See Atlantic.) The continents of the most recent formation may be expected to present more numerous appearances of volcanic fire, and to be more agitated by internal convulsions and earthquakes, whilst in the older continents everything is passing to a more tranquil state, and subterranean fires cease to operate on the surface. Such is nearly the present state of Asia, compared with that of South America and Africa, perhaps, may be considered as a continent newly exhausted; the secondary strata are already carried away in many parts; and the primary mountains, by their decomposition,
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position, are covering with siliceous sand a great portion of
the interior of that country, and rendering it no longer
habitable.

As the greater part of the southern hemisphere is at pre-
sent covered by the sea, and three-fourths of the dry land
are on the northern side of the equator, we may, on the
Huttonian theory, indulge the speculation, that the Indian
ocean and the Southern Pacific will be the sites of future
continents, when Europe and Asia are covered by the
ocean in the next great terrestrial revolution.

Dr. Hutton supposes that the elevation of extensive
continents may require ages for its completion, and that be-
fore the rocks and strata attained their permanent level
above the ocean, they may have been subjected to partial
or more general subfurncies, by which they were again
covered with the sea, and received fresh deposits of sand,
which were formed into stone on their second elevation by
heat. This subfurnc, he thinks, is implied by many phe-
nomena which present themselves to the attentive ge-
ologist.

According to the theory of Dr. Hutton, all vallies have
been originally formed and excavated by rivers. Every
river, says professor Playfair, appears to consist of
a main trunk, fed from a variety of branches, each running
in a valley proportioned to its size, and all of them forming a
system of vallies communicating with one another, and hav-
ing such a nice adjustment of their declivities, that none of
them join the principal valley on too high a level; a circum-
crance which would be infinitely improbable, if each of
these vallies was not the work of the stream that
flows in it. In considering these circumstances, it becomes
strongly impressed upon the mind, that all these channels
have been cut by the waters themselves; that they have
been slowly dug out by washing and erosion of the land;
and that it is by repeated touches of the same instrument,
that this curious assemblage of lines has been engraved so
deeply on the surface of the ground.

If we could trace back the progress by which the ground
has been wafted, till we come in sight of the original struc-
ture, of which the remains are so vast, we might perceive
an immense mass of solid rock, as it first emerged from
the deep, naked and unshaped, and incomparably greater
than all that we now see.

The operation of rains and torrents, modified by the
hardness and tenacity of the rock, has worked the whole
into its present form, has hollowed out the vallies, and gra-
dually detached mountains from the general mass, cutting
down their sides into deep precipices at one place, and
smoothing them into gentle declivities at another. From
this has resulted a transportation of materials, which, both
for the quantity of the whole, and the magnitude of the
individual fragments, must seem incredible to every one
who has not learned to calculate the effects of continued
action, and to reflect, that length of time can convert ac-
cidental into steady causes. Hence, says professor Play-
fair, fragments of rock from the central chain are found to have
travelled into distant vallies, even where many inferior ridges
intervene; hence the granite of Mont Blanc is seen in the
plains of Lombardy, or on the sides of Jura; and the ruins
of the Carpathian mountains lie scattered over the thores
of the Baltic. These loofe blocks of stone point out the
great changes which have happened since the commence-
ment of their journey, and in particular serve to shew, that
many vallies, which now deeply intersect the surface, had
not been begun to be cut when these lofty masses were first
detached from their native rocks, as they could not
have descended from one ridge, and then ascended on the
opposite ridge.

The processes by which vallies are excavated may be seen
in many alpine districts; but it is no where more strikingly
displayed, than in the interfection of the Alleghany moun-
tains, in North America, and particularly where the Poto-
mac river has cut itself a passage through the ridge called
the Blue mountains, in Virginia. By the same process,
elevated lakes are laid dry; and by the transportation of
materials, lower lakes are gradually filled up.

The description given by the Huttonian geologists of the
formation of vallies, is accordant with existing appearances
in many situations; but will not apply to the formation of
all vallies: nor is it correct, that none of the upper vallies
join the lower at a higher level; for numerous instances of
such vallies might be cited, from which the rivers descend
in cascades from the upper to the lower valley. The strata
on the opposite sides of vallies have often a different angle
of inclination; which proves, that the valley had been ori-
originally formed by some great convulsion, that had fractured
the strata, and elevated them on one side, or depressed them
on the other. Indeed it appears consistent with the Hut-
tonian theory itself, that vallies may have been originally
formed by fractures of the strata produced by the convul-
sions to which the continents have been subjected. Through
these fractures the mountain torrents would rush down, and
smooth and widen the passage in their descent.

Many geologists, who admire Dr. Hutton that gra-
nitic and unstratified rocks and mineral dykes were formed
by the agency of fire, do not admit that stratified rocks
have been formed entirely by mechanical deposition from
the ruins of former strata, and subsequently consolidated
by subterranean heat. Nor do they admit, that the causes
assigned for the transportation of blocks of granite into dis-
tant countries are adequate to the effect.

In the seventh volume of the Transactions of the Royal
Society of Edinburgh, sir J. Hall has brought forward
several modifications of the Huttonian system, which he
conceives to be more consonant with the present appear-
ances of the globe. He supposes, that islands or continents
sometimes have been raised from the ocean by a sudden
effect of subterranean heat, analogous to the rapid form-
ation of volcanic islands in our own times. In the latter
cases, where the solid pavement, which forms the bed of
the ocean, is softened by heat and raised to the surface, it
is always accompanied with a great swell of the sea, some-
times forming a single wave of prodigious height. During
the submarine eruption of St. Erini, or Santorini, in the
Grecian Archipelago, which took place in 1650, the sea
rose to the height of 45 feet, and at such a distance
from the volcanic island, that some galleys of the grand
seignior were wrecked in the port of Candia, though it is
more than 80 miles from Santorini.

A great wave or swell of the sea has been generally ob-
served to accompany the more formidable earthquakes.
This phenomenon is in all probability occasioned by the up-
heaving of the bed on which the sea rests, though it may
not always be attended with a submarine volcanic eruption.
Professor Pallas conjectured, that some parts of Asia had
been inundated by the swell of the sea, which is supposed
to have taken place during the formation of the volcanic
islands in the Indian ocean. Sir J. Hall has given greater
extension to this speculation; he supposes, that the upheaving
of a whole continent, or large island, may have taken place
suddenly, as to drive the ocean with great impetuosity
over the highest mountains, and transport vast fragments
of
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of rock into distant countries. By the sudden ruff of such an immense wave, the looser parts of the strata may have been torn away, and the surface of a whole country entirely changed. It is generally admitted, that the continents of the old world bear the marks of a mighty irruption of the waters; but geologists differ with respect to the cause; that assigned by Sir J. Hall is, we think, the most probable, being simple, sufficient for the effect, and in accordance with phenomena that occur on a smaller scale in our own times.

It may be added, that such an immense agitation of the waters, which could carry them over the Alps, and sweep round the globe, would not suddenly cease. The water, before returning to a quiescent state, would frequently revisit the same countries at a diminished level, and assist in transporting still farther the debris formed by the first irruption. The ice on the higher mountains, containing imbedded masses of stone, would be stripped off, and being specifically lighter than water, it would render the stones buoyant, and carry them to distant countries. In this manner, those blocks of granite may have been deposited which are so widely scattered over plains far removed from granitic districts.

That part of the Huttonian system which supposes all the present strata to be mechanical depositions from former continents, is exposed to many weighty objections, from an attentive consideration of these phenomena which appeared on a superficial survey to be favourable to this opinion. The organic remains found in different strata, do indeed inform us, that animals existed before their consolidation; but the occurrence of different genera and species in separate beds, without intermixture with each other, and the gradation which may be observed in the nature of these organic remains, as we ascend from the lower to the higher beds, prove that the materials were not formed and deposited from theconfused debris of former strata. If the strata were formed from the ruins of ancient continents, why do we not find the remains of land-animals in the lower beds, or why should they occur only in the strata above the chalk, or in alluvial soil? The separation of vegetable from animal remains offers a further proof, that the materials were not deposited promiscuously and mechanically; for though vegetable and animal remains sometimes occur in the same argillaceous beds, yet in strata of sand-stone and lime-stone, such intermixtures are very rare indeed.

The formation of coal by the deposition of vegetable matter in the ocean, is equally difficult to conceive. The formation of a single bed of coal might indeed be more easily explained; but a series of beds, presuming the same thickness over a vast extent, and separated from the earthy strata above and below, appear to indicate that they could not be formed by mechanical deposition. Granting the vegetable origin of coal, it would seem more probable that extensive low plains, like the swamps or fawannahs of America, had been covered with mosses and grasses, which in decaying, had settled to the flate of peat, and been buried by inundations with layers of sand or mud, that served as the soil for another vegetable crop. Successive depositions might produce a series of beds, which were by heat and pressure subsequently converted into mineral coal. Some interesting experiments of Dr. Macculloch, published in the second volume of the Transactions of the Geological Society, appear to prove, that the bituminization of vegetable matter can only be effected by moisture; but for the conversion of bituminized vegetable remains into perfect mineral coal, heat and pressure are required.

Another objection to the Huttonian system may be advanced from the recent discovery of a series of strata of siliceous and calcareous stone, perfectly formed over the chalk in the vicinity of Paris. The chalk on which they are deposited has an uneven surface, being elevated and depressed, forming hills and valleys, over which the upper strata are horizontally laid, as represented in Plate II. Geology, 4th. New it is obvious, that the chalk must have been consolidated previously to the deposition of the upper strata; and the succession of animal remains of such different genera and species in the different beds, prove that they were formed at different periods of time. If subterranean heat were necessary for their consolidation, this heat must therefore have been operative long after the formation of the chalk. If this heat had been sufficiently powerful to act on the first three or four hundred feet above the chalk, it must have been equal to fuse the chalk itself, and convert it into crystalline lime-stone, or to soften it so much, as to mould the strata upon it, or at least to shew the effects of heat on the parts most immediately in contact with the chalk. Some of these strata being of the very hardest kind (particularly the mill-stone stratum), they would require, according to the Huttonian theory, an intense degree of heat for their consolidation. See STRATA around Paris.

That fire and water are both important agents in the consolidation of different rocks, is evident from what we are in our times: of the former, we have instances in beds of compact lava; and of the latter, in the recent formation of some sand-stones. The united effects of both are seen in the indurated argillaceous beds erupted in the state of mud from the volcanoes in the Andes. See VOLCANO.

The effects of comprethion at the common temperature of the earth, have not been sufficiently attended to by geologists; nor have there been those changes which are now taking place particularly in the softer strata and beds of sand, but scarcely noticed, though there cannot be a doubt that aggregations are forming, and certain arrangements going on which, if duly investigated, might throw much light on the consolidation of strata. For further observations on the formation of strata, see STRATA.

Whatever changes the Huttonian system must undergo to adapt it to a more advanced state of the science, or whatever may be its ultimate fate, it cannot be denied that it is distinguished by characters of grandeur and simplicity. When we consider how little was generally known of geology at the time this system was first published; how extensively it applies to the various phenomena which subsequent observations have discovered; what a probable, or at least what a plausible, solution it offers to many difficulties in the science; and what confirmation it has received from chemical experiments; we must regard it as one of the most perfect efforts of speculative philosophy.

For further observations connected with the present subject, we refer to our article STRATA, where the reader will find a different theory suggested respecting the formation of stratified rocks. See also Volcan, Metamorphic, and Metalliferous System, in MINORS; and a compound interval, or interval composed, or conceived to be composed, of temporal leis intervals. Such is the octave, &c.

The word is borrowed from the ancients; who called a simple interval, diastem; and a compound one, system. As there is not any interval in the nature of things, so we conceive any given interval, as composed of, or equal to, the sum of several others. This division of intervals, therefore, only relates to practice; so that a system is properly an interval which is actually divided in practice, and where, slop
with the extremes, we conceive always some intermediate terms. (See Interval.) The nature of a system will appear plain, by conceiving it as an interval, whose terms are in practice taken either in immediate succession; or the found is made to rise and fall, from the one to the other, by touching some intermediate degree; so that the whole is a system or composition of all the intervals between one extreme and the other.

Systems of the same magnitude, and, consequently, of the same degree of concord and discord, may yet differ in respect of their composition; as containing and being actually divided into more or fewer intervals; and when they are equal in that respect, the parts may differ in magnitude. Lastly, when they consist of the same parts, or least intervals, they may differ as to the order and disposition of them between the two extremes.

System of the Ancient Greek Music. See Greek Music. In connection with which, see also Composition, Counterpoint, Harmony, Melodia, Mutations, and Rhythm.

Roman Music.——The ancient Romans, who borrowed all their music and its technics from the Greeks, as appears in Vitruvius, Martianus Capella, and Boethius, had no system of their own, yet simplified the notation; and, instead of the 1620 characters of notation, subsumed the letters of the alphabet, and thus formed a scale of two octaves, or a 15th, from the lowest A, or profissimamのある of the Greeks, to our A, in the second space in the treble.

The next partial change in the notation was made by St. Gregory, who, perceiving that after the first septenary, the octave was but a recurrence of the same found as the first note A, and that in ascending to the double octave, the intervals were the same as in the first, reduced all to the seven first letters of the alphabet, only, instead of capitals, wrote the second series in minuscules, or small letters. See St. Gregory.

At length, says Baronius, in the eleventh century, Guido Areteus, in Tuscany, a Benedictine monk of the monastery of our Lady of Pomposa, in the duchy of Ferrara, invented a new system of founds, which, with subsequent additions, is still the foundation of the general and universal system of Europe.

System of Guido. We shall not here discuss, or attempt to ascertain, several inventions included in what is called Guido's system; but specify the principal constituent parts of the system of music which has long gone under his name; such as the gamut, or diatonic scale of tones and semitones; flats, sharps, naturals, hexachords, and foliation; diaphonia, or organizing other terms for the beginning of counterpoint; intervals, diatonic, or forming a part above or below the chant, orplain-song.

The two great defects in the rude system of Guido, as far as it goes, were the want of semitones in transposed keys for harmony and modulation, and a time-table for melody. And those deficiencies occasioned by the ecclesiastical modes or tones, flopped all material improvement in secular music for many ages after the time of Guido. The want of a sharp 7th to all the modes and tones of the church in canto fermo, and their being expressed on a staff of only four lines and spaces in Gregorian notes of only two kinds, the square and lozenge, formed a new genus, and bound in chains both melody and harmony, till the invention of the time-table, and the free use of all the semitones in the modern chromatic scale, till the time of Ockenheim and his admirable disciple Josquin, in the fifteenth century. See Guido, Gamut of Scale, Hexachords, Points, and Counterpoint.

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System of Rameau. This system has been so amply discussed in the articles Bassa Fondamentale, Harmonics, D'Alembert, the Abbé Roussel, and M. Labarre, that we shall add but little here to what those articles contain. He was the first who arranged the scattered rules of music into a system, deducing all melody and harmony from the vibration of a single string, organ-pipe, or great bell; in short, from the harmonics of a low found, which he calls the genus. It had been discovered by C. Buirel and afterwards confirmed by Merkens, that every base or low found divides itself into its aliquot parts, 2, 3, 4, 5, 6; which divisions singly, would be the octave, the 5th of the octave, the 4th of the 5th, or the double octave, the tierce above the 15th or major 17th, minor 3d of the 17th, or 19th above the generator; between the 5th of the octave, or 12th and 17th, we have a major 6th; between the 17th and triple octave, or 8th part of a string, we have a minor 6th. So that as the string is found, we have all the concords perfect and imperfect union, 8th, 7th, and 6th, perfect; and major and minor 3d and 6th, imperfect, all given in the order of their perfection. In extending calculation beyond the minor 3d and the 4th octave, we have all the discords and small intervals in the 9th, 10th, 11th, 12th, and 13th part of a string, even to a comma. And here we have in nature all the intervals in melody, and concords and discords in harmony necessary to composition; but how to use and combine them is another enquiry.

But Rameau, before he entitled his basse fondamentale a system, and divined into harmonics and the theory of found, had published two quarto volumes on practical music, from the scale or gamut and first elements of found, to the composition of fugues, double counterpoint, and canon.

The essence of these practical works had been incorporated by d'Alembert with the theory of found and fundamental base, with clearness and geometric order; and whoever would know the merits of Rameau's system, should seek his knowledge in the great geometricalian's "Elements de Musique theorique et pratique, suivans les Principes de Rameau," to which we shall refer our readers, and to the article Basse Fondamentale.

System of Tartini. The ingenious theoretical writings of the admirable practical musician Tartini, have been reviewed and criticized in France by some, and his right to the discovery of the terno fiume diffused and claimed as his own property by M. Rameau. Rouelle, who was partial to his talents, and opposes his system to that of Rameau, has given it a long article of development and analysis at the end of his dictionary; but not with his usual clearness, feeling, and spirit in speaking of Italian music and music. He has, however, honoured his system with a very flattering eulogy, in saying "the system of the illustrious Tartini, being written in a foreign language, often profound, and always diffused, is accessible to few, and even those few are discouraged by the obscurity of the style of the work before they are acquainted with its beauties. However, this system, if not that of nature, is at least, of all those which have hitherto been published, that of which the principle is the most simple, and that in which all the laws of harmony appear to arise in a less arbitrary manner than in any other." But his theoretical treatises have never been so candidly examined as by our learned countryman Stillingfleet, in a professed commentary, under the title of "Principles and Power of Harmony," which he has rendered one of the most agreeable and amusing books on the subject of music, as well as the most instructive in our language. And to this work
work we shall refer our readers who wish to be better acquainted with Tartini.

The work in question, which Mr. Stillingfleet has commented on, was published at Padua, in 1704.

Mr. Stillingfleet probably treats St. Anthony of Padua's first violin with more respect, from having heard him perform, and being well acquainted with his compositions and character. He does not always subscribe to his opinions, and sometimes, like left partial critics, complains of the obscurity of his style, and want of found geometrical science; yet he points out so many profound and ingenious thoughts, so much refinement and feeling in melody and harmony, that whoever peruses Tartini, with Stillingfleet for his guide, will not only admire many parts of his treatise, but entirely love and reverence the author. Mr. Stillingfleet takes no notice of Tartini's second treatise, entitled "De principi dell' Armonia musicale, Contenuta nel Distantico Generale Differentationi," 4to. 1767. But Tartini himself says, that it was written only to explain the first.

The system of Tartini, as explained by Stillingfleet, has a large share of importance in the supplement to the first folio edition of the Encyclopædia, among materials with which the editors were furnished from Germany, chiefly extracted from the "General Theory of the fine Arts," by M. Sulzer of the Royal Academy of Sciences at Berlin. The author of this work was director of the philosophic clafs in the Royal Academy, and author of several works in literature and science that were much esteemed. He was particularly attached to music, which he had studied very seriously, though only a dilettante. Yet he drew up the chief music articles of his work, which was published in 3 volumes, 4to. in the form of a dictionary, under the counsel of Agricola, Schultz, and Kirnberger, who had been his music-master, and of whom he speaks in the highest terms of respect and friendship.

After analyzing the principal musical systems that have been current at different periods, in the several parts of the world, the encyclopedists introduce what is called Kirnberger's system, in the following manner.

"In all the systems which we have analyzed, we have had recourse to physical experiments, to calculations, and to analogies. The chief part of the experiments depend on the ear, as this organ is the sovereign judge of music. All the systems which we have analyzed, (a term in periodical works of criticism, at present, by which we understand reviewed,) in assigning reasons for many things, leave others in obscurity, and oblige us to abandon various harmonical combinations, to which we have been long accustomed. If, therefore, a system is found, supported on a few simple principles, which reduce all harmony to two chords only; which, however, accounts for all harmonical phrasing and transitions employed by good masters, however capricious these transitions may appear; if this system, notwithstanding its simplicity, requires no change, even in our diatonic scale, nor obliges us to abandon any harmonical practice allowed to be good by great composers in Italy, Germany, or even in France; it is, then, the system of Rameau; for it seems as if we might reasonably regard it as the only true system, and consequently that which we ought exclusively to adopt.

"We are now going to analyze such a system, which is that of M. Kirnberger, a celebrated German musician, at present (1777) in the service of her royal highness princess Amelia of Prussia. We can answer for the accuracy of the analysis, as it has been drawn up under the inspection of the said princess, who have the happiness to be particularly acquainted, and to whom we are indebted for all that appear curious and useful in harmony, throughout the different articles of this supplement. This confidence would wound our self-love, if the satisfaction of acknowledging publicly all that we owe to M. Kirnberger did not overpower every other sentiment."

This system having been adopted and explained by Mr. Kollmann, in his "Essay on Musical Harmony," published in 1796, and in his "Essay on Practical Composition," 1796; as we have referred our readers to d'Alambert's "Elements de Musique," for a clear and well-digested analysis of Rameau's system; and to Stillingfleet, for an excellent commentary on Tartini's system; we shall only point out the principles on which Kirnberger's system is founded, and refer our studious musical readers to Kollmann's full development of the system of his profound countryman.

"Since music is made for the ear, its principles ought to be founded on the judgment of that organ.

"When we speak of the judgment of the ear, we mean the judgment of the majority of the greatest musicians. If we were to be guided by the ears of every individual, we should never have done.

"Our music consists of different intervals; their name, the manner of expressing them, &c., we suppose already known.

"Intervals are considered either in succession, as melody; or in their combination, as harmony.

"With respect to melody, intervals are easy or difficult to express; with respect to harmony, they are discordant.

"A consonant and uniform expression proves the most consonant intervals are the most easy to express; for which reason it is necessary to learn the degree of consonance in each interval.

"To know the natural cause of consonance and dissonance of tones is often wished. The greatest philosophers are of opinion that the intervals, of which the ratio is the most simple, are likewise the most consonant; and experience leans to this opinion. Two strings of equal length, thicknes, and tension, produce two sounds so similar, that one cannot be distinguished from the other. To confirm, therefore, is regarded as the most perfect concert. After the concord, the ear finds the octave the most consonant interval; it has two sounds, but so united together as hardly to be distinguished. They are indeed two sounds, but not two different sounds: the length of the string, which produce an octave, or, if you please, the number of vibrations, is as 1 to 2; a ratio the most simple, after that of 1 to 1; after the octave comes the fifth, of which the ratio is 2 to 3; then the fourth, 3 to 4, &c. in the most well-known proportions," till we come to the second, which is in the proportion of 8 to 9. "The more the chord and minute the intervals," says Kirnberger, "they are always the more dissonant. The second minor, therefore, is more dissonant than the major.

"The minor third, in the ratio of 5 to 6, is generally regarded as a concord; but as it will bear a little diminution, without ceasing to be a concord, we have a right to conclude that the interval in the ratio of 6 to 7 is the last concord, and of 7 to 8 the first discord."

"This is our doctrine. More liberties have long been taken with the flat 7th, than with any of the other intervals.
The ceremony of preparing it has been long relaxed; but it has never, till lately, been numbered with concords.

"It is true," continues Kirnberger, "we do not find the interval of 6 to 7 on our keyed instruments; but the trumpet gives it. Every one knows that the trumpet and French horn give A and B♭ too low, and F too high; but few know that the tones of the trumpet and French horn are the two natural tones."

New doctrine again. We never yet met with a practical musician, or a lover of music with a good ear, who did not complain of the false intonation of the trumpet and French horn, particularly in the 4th and 6th of their scale.

"It can be proved that every string or bell gives, besides the principal tone, expressed by 1, the tones expressed by ½, ⅔, ⅔, ⅔, ⅔; all which together produce the total found: so that the tone which horn-players regard as B♭, is a true natural tone, expressed by ½, &c.; as F is by ½, and A by ½."

We should do well, therefore, to adopt the tone ½ in our musical system, which is included in the first octave ½: in calling C the fundamental found, which we call i, it would fall upon A ½, and on B♭ ½.

"The chord C, E, G, i, is literally a chord of four founds, or consonant parts, and not the chord of the flat 7th. This is proved by the use which the best composers make of the extreme sharp 6th, and of the minor 7th, which they treat as concords, doubtless because the ear takes them for the interval ½.

"As the minor 3d, ½, is the smallest concord, the major 6th, ½, which is its inversion, will be the greatest; and we have, before the union and octave, fall four kinds of concord, the tierce, the fourth, the fifth, and sixthth; or, rather, we have but two, the sixth being a tierce, and the fourth a fifth inverted.

"But we must not regard all the 3ds, 4ths, 5ths, and 6ths, as concords. Intervals have their names from their place in the diatonic scale; so that their intervals are called 3ds, 4ths, &c. on account of their situation in the scale, though they are very dissonant: thus, C, C &c., a false relation or redundant octave; a sharp 4th, or tritone, &c.

The following are the true concords, and their ratios:

| 3d minor, ½ | 6th major, ½ |
| 3d major, ½ | 6th minor, ½ |
| 4th ½ | 5th ½ |

"And if the note i or ½ be admitted, the interval is expressed by ½."

"These intervals are in their greatest purity; but experience tells us that they may be a little altered, without becoming discords. The 4th may be a semi-comma, or ½, too sharp; and, consequently, the 5th as much too flat. The major 3d may be a whole comma, or ½, too sharp; and the minor 6th as much too flat. And, finally, the minor 3d may be a comma, or ½, too flat; and the major 6th, consequently, as much too sharp. All other intervals are discords."

"In the music of the present times (1777), every melody is accompanied by different simultaneous melodies, which make but one whole with the principal: at such times we, therefore, hear many tones or founds at once. These assemblages of simultaneous founds are denominated chords; and the effect which results from them, harmony."

Then follow the usual and well-known definitions of common chord, chord of the 6th, and chord of the 5th, all arising from the triad; unison, 3d and 5th, or 3d, 5th, and 8th, to the fundamental base, or harmonic triad.

"It is probable (we are sure, from our researches, that it is certain) there was music in parts, long before discords were introduced in counterpoint."

He next gives the usual rules for preparing and resolving discords.

The origin which he gives of the minor 7th, in the chord of the 5th of the key, and to all other regular 7ths, is the same as in every other elementary book. (See Discords.) The minor 7th, and the major or sharp 7th, called by the French la note faible, have very different effects on the ear: the flat 7th tends to a defect, and, like Falstaff, "has an alacrity in sinking:" whereas the sharp 7th has a contrary disposition, and, as if charged with gas, forces its way upwards. The sharp 7th and the sharp 4th are the only discords that are resolved upwards.

It is the usual minor or flat 7th that Kirnberger calls the one essential discord. He next distinguishes three kinds of triads, or common chords: the common chord with a major 3d, with a minor 3d, and with a minor or flat 5th.

The last can only be used in the course of a passage or musical period, but never at the beginning or the end.

"In four parts there are four ways of playing or writing the chord of the 7th, which are well known to thorough-bass players."

It is by making each of these chords an appoggiatura, orfulness to it to the next base, and calling the whole chord an accidental discord.

The reducing all discords to one essential discord, is rather an evasion of the difficulty of learning all the usual discords, than a solution. The student will still have to learn what the common chord of the key-note will make to every note of the scale ascending and descending, and what the discord of the 7th will make to whatever note it is struck or applied in composition; which will not be learned the sooner for having new names, or being called accidental instead of essential. The rest must be learned, whether by their old names, or by no names at all.

The new note ½ has not yet been adopted by composers or performers.

The author of this system takes great pains to explain the difference between the accidental and essential discords. But we fear that many of these distinctions are so nearly without a difference, as not easily to be retained by a student in harmony. M. Kollmann’s plates will smooth many difficulties in this study, which the plates in the Supplement to the Encyclopédie leave in obscurity.

When the author quotes this subject, which he takes great pains to explain, he proceeds to account for many chords which appear singular.

"The chord of the superfluous 6th, as Roussel has well remarked, is only the chord of the minor 6th sharpened by accident. When our old musicians wished to make a pause on the 5th of a minor key, it was done by means of the natural 6th major, which led to the chord of the 5th of the key with a sharp 3d; which was called a semi-cadence."

We have mentioned all the singularities of this system, and what remains, though the found and good doctrine of the bent matters, is not new, and therefore needs no particular explanation.

We have enumerated all the musical systems that seem intituled to praise from their originality, or to adoption for their improvement of former principles. Many have called their publications new systems; but though some of them contain much ingenuity of arrangement, and some additions to former systems, they are not constructed on new foundations; such are those of M. Sauvage, of the great geometrician Euler, 5 B 2.
Euler, of M. Boiguelou, of M. Serre, Dr. Smith's "Harmonics, or System of Tuning by Beats." M. Jamarf, the worthy ci-devant canon of St. Genevieve, prior of Rocquefort, member of the Académie de les Belles-Lettres et Arts de Rouen, who escaped to England from Normandy during the revolution, with forty more ecclesiastics, in a leaky vessel, into which they were forced, with the intention of its being their passage-boat to the other world, published in 1769, an ingenious tract, entitled "Recherches sur la Théorie de la Musique," totally different from the practice, putting, it should seem, the ear out of the question ; and fancying the bad notes in the French horn to be the harmonics of nature, the auricular organ is not gratified by his system. And as none of the sysmes, as they have been called, are received into practice, we can only allow them to be ingenious hypotheses or speculations, sometimes correcting, and sometimes elucidating established theories.

The taking the French horn as the standard of harmonic perfection, which is so notoriously false in the two intervals of the 4th and 6th, will alarm every nice and cultivated ear, and make them fear the result of their calculations.

Here Kirnberger, an excellent practical musician, and profound contrapuntist, deserves more respect than mere speculativists; but we cannot call his an original system on a new foundation; he has refined on the old system, and proposed improvements. He is neither a blind follower of Rameau nor Tartini; but hears safely between both. There is so little nature in music, that we seize on the slightest indication of her support.

The new scale of M. Jamarf would involve music in great confusion. It was a language, in the old scales, which had only two expressions; it has, according to the venerable prior of Rocquefort, 56 in every octave.

**Chronological History of zA, a new Interval in Secular Music.**—Tartini, in 1754 and 1767; Balliere, in 1764; Jamarf, 1769; Stillingsfleet, 1771; Kirnberger the same year, in the Supplement to the folio edition of the Encyclopédie, 1777; and Kollmann, 1796, in his "Essay on Musical Harmony."

Tartini, when he first mentioned this new found in his "Trattato di Musica," p. 126, says: "Naciamo dalla diversa armonica della facque terra, o fa quarta, ed un sesto, che questo intervallo è di facilità una iniziazione fino il violino, ed è voluto dalla natura armonica perché è tale fatto dalla natura nelle trombe marine e da dato, e se così di caccia; armonica ne' quali non a luogo l'arbitrio senza nella tota fisico-armonica natura. Si aggiungano dunque in nota musicale il termine quinto e sufficiente il sestetto intervallo alla scala diatonica commune infissata dall'ellen pe4; e questa nota aggiuntesi segno con la cifra w9 a dimissione di B fa segnato con la cifra B."

Though, as Tartini says, it is in nature, and of easy production by the voice and violin, upon keyed and wind-instruments it is purely imaginary.

Tartini thinks that, with the sufficiency of this new found, the enharmonic may be recovered.

In Stillingsfleet's remarks on what Tartini says of the ancient enharmonic being contrary to the principles of harmony, the commentator tells us that he undertakes to give us an enharmonic of his own, by means of this new note, which is out of the limits of the hexachords, which he calls a conformance.

This note seems brought into use in melody, particularly in defending, though unnoticed in harmony. See Music Plate.

But the intonation of wind-instruments in general is false, particularly on the trumpet and French horn, in which the 4th and 6th differ so much from the instruments and the voice which is formed upon them, or at least is obliged to conform to them, that no composer dares use them in any thing but transient passages; in slow and sustained parts, they offend every natural ear; but the w9, or new Bb, of these instruments, if dwelt upon, or even used at all with other instruments which have no such found, would drive an audience mad, or at least out of a theatre or concert-room.

The 3ds, given by the abbé Rouffier's triple progression, and 4ths and 6ths of Balliere, Jamarf, and Kirnberger, a union with those intervals in the trumpet and French horn, we cannot reconcile our ears to, though recommended by our favourite composer Tartini.

The flat 7th, given by the last effort of the English harp, is not so offensive as that of the trumpet and French horn. But nature gives us no music; it is all a work of art. Let us, therefore, make it as pleasing as we can to that sense for which it is alone designed. There is a little pedantry in Kirnberger's treatment of the subject. To all
his other precepts we can subscribe, as they are the result of great experience, professional knowledge, and sagacity. We know not whether his treatise should be called a system, like those of Guido, Rameau, and Tartini; the first built on the Grecian system, and the two last upon physical phenomena. Kirnberger’s is but the last refinement of old doctrines. He says, that the 4th, the 5th, and flat 7th of the trumpet and French horn, should be adopted in our system, “for they are the true natural tones.” We repute nature very much; but is not nature improved very much by cultivation in fruits and flowers? and why do all professors and perfumiers of nice ears complain of the difference of wind-instruments? System of Solmisation. Dr. Wallis makes use of only four of the fix syllables ascribed to Guido: mi, fa, sol, la; which method resembles that of the ancient Greeks in naming the sounds of the tetrachords ευ, τυ, υι, το. But it appears in Cliffor’s Collection of Divine Services and Anthems, published in 1664, that the English began to discontinue the use of two of these syllables of the hexachords, the se and re, about the year 1650. Dr. Pepusch, however, in 1731, revived the ancient solmisation, and informs the vocal student, in his “Treatise on Harmony,” p. 70, that the mutations begin on the third note before Fa, which must be called re ascending, and la descending.

Let the intervals in all major keys have the same names in elementary singing, as in the key of C natural.

C D E F G A B C
Do re mi fa sol la mi fa re mi do

descending

C B A G F E D C
fa mi la sol fa re do.

In keys with minor 3rd, let the notes have the same names as in the key of A natural.

A B C D E F G A
La mi fa re mi fa sol la

descending

A G F E D C B A
la sol fa mi re fa mi la.

Such as you frequently meet with in the above diffracts. And it is still further removed from the West country downs, where, in addition to the general clean face of the country, the quagmires are converted into luxuriant water-meadows. But even these do not come up to the Leicestershire husbandry, where they do not employ sheep as dung-carriers, for the purpose of impoverishing two-thirds of their land in order to enrich the other, but, on the contrary, cultivate the whole, and, by dividing their farms into moderate-sized fields, and by raising good hedges, to afford shade from the scorching heat of the sun in the dog-days, and shelter from the nipping frosts in winter, have prepared the way for improvement in live-stock, in which they have already arrived at a degree of perfection altogether unrivalled; and both fleece and cattle are confidedly more highly conditioned than those of any of the foregoing districts.

Yet the Leicestershire husbandman, though standing very high in the scale of perfection, is much exceeded by the very superior management of the meadow and arable farmers, and likewise by the fruit and kitchen gardeners, of the county of Middlesex; since there is no land in that county, with the exception of the commons, from the well protected and healthy copses at Ryhill, to those wonderful of their kind, the gardens at the.Net-houses, but what is cultivated, and, for the most part, raised to a great degree of fertility.

And there are probably some other tracts, or districts, in which the systems of husbandry may be still superior to any of thefe, though nothing certainly will any where be found to exceed the Net-thouse culture about the metropolis. Systematical Qualities, a term used by Mr. Boyle, to express such qualities as are also called specific, and do not depend on the nature and constitution of the body itself,
SYZ

itself, but on its being a member of this general system of the universe, in which capacity it is acted upon by agents unperceived by us, which occasions great changes in it.

SYSTEMATISTS, in Botany, those authors whose works in this science are principally employed about the arranging plants into certain orders, classes, or genera. See Botany.

SYSTOLE, from συστολής, to contract, in Grammar, designates the shortening of a long syllable.

SYSTOLE, in Anatomy, contraction; it is usually applied to the heart, and denotes its contraction, for the purpose of expelling its contents.

SYSTREMMA, a word used by Hippocrates to express a collection of humours, forming a hard tumour, or tubercle, in any part of the body; called also sometimes syphrombe.

SYSTYLE, in Architecture, that manner of placing columns, where the space between the two futs consists of two diameters, or four modules. See INTERCOLUMNIATION.

SYTHERE, in Agriculture. See SYTHE.

SYXHINDEMEN, a term purely Saxon, literally signifying fixed-hundreders, or men worth fix hundred shillings a-piece. See HINDER.

SYZYGIUM, in Botany. Gertr. v. 1. 166. t. 33. (Synonym of Browne's Jamaica. 240. t. 7. f. 2.) apparently so named by the latter, from σύζυγος, a conjunction, or copulation, in allusion to its "coupled leaves and branches," is the Myrtus Synzygium of Linnaeus; but, as we conceive, rather belongs to the genus Eugenia. (See that article.) Gartner distinguishes it only by having a berry with a single seed, instead of a drupe. Jussieu however unites them. The pulp is indeed closely attached to the seed in Synygium; but the shell, or rather skin, is so thin in Eugenia, that it is hard to draw a line between these two fruits. Gartner's distinction, founded on the two cells of the genus in Synygium, does not hold good, the same being found in Eugenia, though it always becomes obliterated as the fruit ripens; just as in Olea.

Gartner enumerates four species of Synygium. 1. S. caryophyllum, a Ceylon plant, which he supposes to be Myrtus caryophyllaco of Linnaeus. 2. S. Makul, from the same country, with a more oblong fruit. 3. S. paniculata, which is Eugenia paniculata of the Bankian herbarium. 4. S. lucidum, Euginia lucida of the same collection. The original Jamaica plant of Browne is not included in this list.

SYZYGY, SYZYGIA, formed from συζύγος, which properly signifies conjunctionio in Aetymology, a term equally used for the conjunction and opposition of a planet with the sun.

On the phenomena and circumstances of the syzygies, a great part of the lunar theory depends. See Moom.

For, 1. It is shewn in the physical astronomy, that the force which diminishes the gravity of the moon in the syzygies, is double that which increases it in the quadratures; so that, in the syzygies, the gravity of the moon, from the action of the sun, is diminished by a part, which is to the whole gravity as 1 to 89.36; for, in the quadratures, the addition of gravity is to the whole gravity as 1 to 176.73.

2. In the syzygies, the disturbing force is directly as the difference of the moon from the earth, and, inversely, as the cube of the difference of the earth from the sun. And at the syzygies, the gravity of the moon towards the earth receding from its centre, is more diminished than according to the inverse ratio of the square of the distance from that centre. Hence, in the motion of the moon, from the syzygies to

the quadratures, the gravity of the moon towards the earth is continually increased; and the moon is continually retarded in its motion; and, in the motion from the quadrature to the syzygies, the moon's gravity is continually diminished, and its motion in its orbit is accelerated.

3. Further, in the syzygies, the moon's orbit or cirk round the earth is more convex than in the quadratures; for which reason the moon is less distant from the earth at the former than the latter. When the moon is in the syzygies, her apodes go backwards, or are retrograde.

When the moon is in the syzygies, the nodes now are antecedentia fasted; then flower and flower, till they become at rest when the moon is in the quadratures.

Lastly, when the nodes are come to the syzygies, the inclination of the plane of the orbit is the least of all.

Add, that these several irregularities are not equal in each syzygy, but are all somewhat greater in the conjunction than in the opposition. See Physical Cause of Moon's Motions.

SZADECK, in Geography, a town of the duchy of Wawlaw; 22 miles N.E. of Sied Infinite.

SALGEN, or Island of Serpents, a small island in the Black sea, near the mouth of the Danube. N. lat. 430; E. long. 30° 54'.

SAMAILI, a town of European Turkey, is in Babia, on the Dnieper; 45 miles S.W. of Bender.

SAMOSFALVA, a town of Transylvania, on the river Samos; 5 miles N. of Colovar. N. lat. 47° 18'. E. long. 23° 23'.

SAMOSVIVA. See SAMOSVIVAR.

SZARIGROD, a town of Poland, in the province of Podolia; 30 miles S. of Bar.

SZARNOVA, a town of Prussia, in the palatinate of Culm; 8 miles N.W. of Thorn.

SZASK, a town of Lithuania; 36 miles S. of Minik.

SASY, a town of Hungary; 4 miles E.S.E. of Czarnita.

SATHMAR. See SATMAR.

SAWLE, a town of Samogitia; 28 miles N.E. of Miedniki.

SZELENHORS, a town of Hungary, on the river Turin. In the year 1604 this town was taken by the troops of Count Botkay, and in 1655 by the Turks; 30 miles N. of Calchau. N. lat. 49°. E. long. 20° 49'.

SZEKENY, see HESSEN-NASSAU.

SZEGER. See ZGOHN.

SZEKELEY, or SZEKELEY-NID, a town of Hungary; formerly a fortification. In the year 1660, it held out against the Transylvanian peasants; in 1664, it was surrendered by the Imperial garrison to the Transylvanian prince, Abaffy; but in the ensuing year it was demolished; 7 miles N.N.W. of St. Job.

SZEKZARD, a town of Hungary, on the river Szevits, with a castle; celebrated for its wine; 18 miles N.E. of Funffkirchen.

SZELENTHA, a town of Prussia, in the palatinate of Culm; 5 miles S. of Strafsburg.

SZELEITZE, a town of Hungary, near which is a large and celebrated cavern, which is said to be extremely cold in summer, and, on the contrary, to be hot in winter: a noble wonderful account has been given of the different effects of the heat and cold, which Dr. Townson, a late traveller in Hungary, seems not willing to give credit to; 5 miles W. of Calchau.
SZERBANEST, a town of Walachia; 10 miles N.N.E. of Rucaci.
SZERBESTI, a town of European Turkey, in the province of Moldavia; 52 miles S.W. of Jaffy.
SZEREGNYE, a town of Hungary; 12 miles N. of Munkacz.
SZERESSOW, a town of Lithuania; 40 miles N.E. of Bresikie.
SZERN, a town of Prussia, in Oberland; 4 miles E. of Gardenee.
SZERWENTY, a town of Lithuania, in the palatinate of Wilna; 16 miles S.E. of Wilkomierz.
SZIGET. See Ziger.
SZINYE, a town of Hungary; 14 miles E. of Cachau.
SZISH. See Sistova.
SZITES, a town of Transylvania; 4 miles W. of Schéfburg.
SZITTEKEMEN, a town of Prussian Lithuania; 14 miles E. of Goldapp.
SZKOLYN, a town of Austrian Poland, in Galicia; 70 miles S.W. of Halicz.

SZMOLNOK. See Schmolnitz.
SZOBOTISZA, a town of Hungary, on the river Maricch; 32 miles W. of Topoltzan.
SZOBOW, a town of Poland, in Moldavia; 20 miles N.W. of Warsaw.
SZOMBOR. See Zombor.
SZOMUS, a river of Moldavia, which runs into the Siet, near Dobrata.
SZOPIA, a town of Sclavonia, on the Drave; 27 miles N. of Polesga.
SZORENY. See Severin.
SZREBERNEK, a town of Bosnia; 30 miles N.N.W. of Zwornik.
SZREDITS, a town of Croatia; 16 miles E. of Carlstadt.
SZTROPKO, a town of Hungary; 28 miles E.S.E. of Palotza.
SZYATY, a town of Lithuania, in the palatinate of Troki; 48 miles N.N.W. of Troki.
SZYDLOW, a town of Samogitia; 8 miles N.N.E. of Rofenice.

END OF VOL. XXXIV.